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PROMOTION OF THE MECHANIC ARTS.

FEBRUARY, 1848.

CIVIL ENGINEERING.

First Annual Report of the Directors of the Pennsylvania Railroad Company, to the Stockholders, October 30, 1847.

GENTLEMEN,—The period has arrived when, under the provisions of the nineteenth section of the Charter of the Company, the Board are required to present to you an account of their proceedings before surrendering to you the trust which has been confided to them.

Upon entering the duties assigned to them, in the prosecution of a work of such magnitude, in which their fellow citizens hold a deep stake, and in which the future prosperity of the city is largely interested, the Board felt their responsibility, well knowing that a false step at the commencement would damp the ardor of its friends, and jeopardize its final success.

Earnest consideration was therefore given to the most effective organization of the Engineer corps, upon which success in a great measure depended, and the Board determined to place that department under an efficient head, who should control the whole, with two associates, to have charge, under his direction, of the two divisions of the road respectively.

In the selection of a Chief Engineer, the Board were fortunate in obtaining the services of Mr. John Edgar Thompson, a gentleman of enlarged professional experience and sound judgment, who had ob-

tained a well earned reputation upon the Georgia road, and in whom the Board place great confidence.

The office of Associate, West, was filled by the election of Mr. Edward Miller, a gentleman well known and appreciated in this community, who has occupied several prominent positions in his profession, with entire credit to himself, and enjoys the merited confidence of all companies who have employed him.

As Associate, East, Mr. Wm. B. Foster, Jr., was appointed, a gentleman who has for years filled important stations, in connexion with the State works, and who has proved himself an able and efficient officer.

The experience of the past summer has satisfied the Board that in the organization of this department they have nothing to regret.

The Board, at an early day, turned their attention to an object, which they deemed it incumbent on them to secure if possible, for which their constituents had manifested great solicitude, and took immediate measures to prevent the Baltimore and Ohio Railroad Company availing itself of the Law passed by the Legislature of this State, granting to that Company the right of constructing a road from Cumberland to Pittsburgh.

To effect this, a subscription to the amount of three millions of dollars, and the payment of one million into the treasury of the Company, were required by the Act of Assembly, and to have fifteen miles of road put under contract for construction at each terminus of the Pennsylvania railroad, prior to the thirtieth day of July, 1847. The instalments were therefore called payable on the first days of May and July, and were promptly met by the stockholders. These instalments, with that already paid at the time of subscription, amounted to nine hundred thousand dollars, and the deficiency was met by payments, in anticipation of the fourth instalment, from Stockholders, who came promptly forward to a sufficient extent, some of whom paid up their stock in full.

In the month of July, contracts were made for the construction of the road the required distance, and on the second of August, the Governor issued his proclamation, declaring the law giving to the Baltimore and Ohio Railroad Company the right of way through Pennsylvania null and void.

The good effect of this measure upon the general interests of the Company has been made strikingly manifest, by putting it, in the offset, in a state of high credit, and by imparting to it a public confidence which cannot fail to facilitate future subscriptions that may be necessary for the completion of the road.

The policy to be pursued by the Board in the management of this work was plainly indicated.

The law requiring fifteen miles at each end to be put under contract was fulfilled, but at this point so unwise a course stopped.

With this exception, the attention of the Board was directed to the Eastern end, with a view of bringing into profitable use that portion of the road which would soonest make a return to the stockholders.

An examination of the different routes which had been indicated by

former surveys and public opinion, led irresistibly to the conclusion that the Valley of the Juniata was, on all accounts, to be preferred, presenting greater facilities, easier gradients, and less distance, with the decided advantage of being brought into profitable use at a much earlier period than either of the others.

Accordingly, it was determined to adopt and place it under contract as rapidly as it could be prepared by the Engineers. Twenty miles were let in July, which are now rapidly progressing towards completion. Forty miles further, to Lewistown, will be let to contractors on the twenty-sixth of November, and the Engineers are now actively engaged in locating the line, with a view of placing the remainder of the eastern division, to the base of the mountain, under contract early in the spring. As soon as the Engineers have completed their operations, a report from the Chief Engineer, with an estimate of the cost, will be made and published for the information of the stockholders.

The surveys and location of the western division cannot be completed until early the ensuing summer, but sufficient information will be obtained from the surveys of this year to enable the Engineers to give an estimate of the cost of the whole road, with considerable accuracy. The line of the road upon the eastern side of the mountain has been finally determined and proves highly favorable. The whole length of the road from Harrisburg to Robinson's ridge, at the foot of the Allegheny, is one hundred and thirty-five miles, upon which there is no ascending gradient exceeding sixteen feet per mile to Lewistown, and twenty-one feet for the remainder of the distance, nor a descending gradient exceeding ten and a half feet per mile.

From Robinson's ridge, which divides the little Juniata from the Frankstown branch, north of Brush mountain, the ascent of the Allegheny is commenced, and overcome (with the use of locomotive power) by a gradient of about eighty feet per mile in thirteen miles, without encountering any extraordinary difficulties. This work will be left for a future period, and in the mean time a junction will be formed with the Allegheny portage by a branch line, six miles in length, from Robinson's ridge to Hollidaysburg, or some point further west. From the summit of the Allegheny to Pittsburgh, the line will pass over an uneven country, requiring maximum gradients of fifty feet per mile in both directions. The whole length of the road from Robinson's ridge to Pittsburgh will fall somewhere between one hundred and ten to one hundred and twenty miles.

The general plan determined upon by the Board is to proceed with the western section as soon as the eastern division is complete, unless means are provided to prosecute both simultaneously, and to bring them into use by connecting with the Allegheny Portage, while the mountain, or middle, division is in the course of construction.

From present prospects, the Board anticipate being enabled to run their cars from Harrisburg to Lewistown before the close of the winter of 1848–49, and the winter following, with the means now at their command, to connect with the Portage at Hollidaysburg, which, with the completion of the western fifteen miles, will give a continuous railroad communication between Philadelphia and Pittsburgh, with

the exception of fifty-five miles to be traveled by stages; and the Board anticipate at that time a very large proportion of western travel over the road.

The importance of securing a supply of iron in time early engaged the attention of the Board, and they were desirous of obtaining it from the mines of Pennsylvania. With this view, they offered to contract for a sufficient amount to afford an inducement to erect new iron works for its manufacture.

After some negotiations, they finally closed with the offer of David Reeves for fifteen thousand tons, the amount required for the eastern section, at sixty and one half dollars per ton, being about ten dollars per ton less than the market price at that time on the seaboard. The amount required, and prospect of future orders, determined the bid, which was considered a very advantageous operation for both parties. Mr. Reeves has commenced the erection of his works in Lancaster county, and will be prepared to deliver iron in the month of June next, being the time it will be required for the track.

Since the period when this enterprise was first undertaken, a marked change has manifested itself in the public mind with respect to its feasibility and prospects of profit. At that period, the subscription to the stock was considered by many as a patriotic endeavor to retain and extend a trade which legitimately belonged to this city, and which was about to be wrested from her grasp by her enterprising rivals.

A glance at the subscription book attests the existence of this feeling, for out of some twenty-six hundred subscriptions near eighteen hundred are for five shares and under. The books at that time were carried from house to house by the active friends of the road, who solicited even single shares, and the powerful aid of public opinion was brought to bear upon the city authorities to induce a large subscription, lest private enterprise should be inadequate to the task. Of the importance of the work to the true interests of the city and State no one ever entertained a doubt. If any had been entertained, the recent disaster to the State public works of Pennsylvania must have removed it.

In a single night, the whole range of canal along the Juniata was swept by the flood; more than twenty thousand tons of goods in transit left along its banks, to be wagoned east and west at a heavy expense, and the channel of communication between the east and west interrupted for nearly two months, leaving the country full of produce, coal, and iron, unable to find an outlet to market for the next six months, and materially interrupting the business prospects of the merchants both of Philadelphia and Pittsburgh.

Such an occurrence, which the canal must at all times be subject to, has awakened the attention of the whole country to the necessity of pressing the work forward with the utmost vigor.

As an investment, this work is now viewed in a very different light from what it was a year ago.

Since the road has been seriously undertaken, with an earnest determination to bring it rapidly to a completion, its prospects have been more carefully scrutinized, and every fact which has been developed

in the public prints has gone to show that when in operation it has a field open to it which no other enterprise of the kind presents.

Already the citizens of Ohio are combining their energies to extend our line through the fertile valleys of that State, and form a continuous way from the Atlantic to the far west. Even from Pittsburgh alone, a vast trade must open to it, which has never been taken into account, in the single item of cattle, of which more than fifty thousand are annually driven through Pennsylvania from Ohio, and which can be transported over the road at a large saving to the drover, yielding abundant profit to the Company.

That the Pennsylvania railroad must yield an immediate profit on the investment is generally admitted by all well-informed persons, and we may now look to capital seeking investment, and not to patriotism to furnish it.

The manifest advantages to be derived from an early completion of the whole line call for a recommendation from the Board that immediate steps be taken to raise sufficient capital to render it available in the shortest possible period.

The amount now subscribed exceeds three millions of dollars, which, it is safely calculated, is sufficient to put the road in operation to the base of the Allegheny, and connect it with the State Portage. This portion of the work is now being constructed as rapidly as is consistent with judicious economy.

The western section may be considered as a distinct work, and can, without detriment to the interest of the Company, be put under contract at the same time as the eastern, thus effecting a saving of nearly two years in the completion of the whole. A united effort should, therefore, be made both in the east and the west, in order to enable the Board to commence the work as soon as the surveys are complete.

It is fortunate that the unfriendly feelings which divided us from our western fellow citizens have been allayed, on both sides, by time and calm reflection. Both parties now see that their interests are inseparably united, and we have the strongest assurances from prominent persons, who were most active in forwarding other interests, that they are ready to unite with us, and give their hearty co-operation. Measures are now in progress in Pittsburgh which, it is hoped, will lead to a large subscription from the citizens and authorities of Allegheny county.

To place the Company in a strong position, and unite all interests in its behalf, some legislation will be important, which, it is supposed, will not be difficult of attainment, as many interests which heretofore were adverse will now act in accordance with the wishes of the Company.

A careful examination of the law will be made prior to the ensuing session of the Legislature, with a view to such minor changes as will add to its efficiency. The Board now call the attention of the Stockholders to two important amendments, for their sanction.

One, which will materially affect future subscriptions, is the supplement presented and asked for at the last session, granting to municipal

bodies the right to subscribe to the stock of the Company; a law which would, under certain restrictions, give the Company the right to accept the certificates of loan issued by municipal corporations in payment of instalments for stocks, will have a most beneficial effect upon our subscriptions.

The tenth section of the charter of the Company provides that, after bona fide contracts shall have been made for the immediate construction of fifteen miles of the road at each end thereof, a sum equal to five per cent. per annum on the capital stock of said Company actually paid in shall be estimated and paid to the several holders thereof, on account of the amounts payable by them respectively for stock subscribed, to be charged to the cost of construction.

This clause was doubtless intended by the Legislature to place the original stockholders upon a just footing in point of interest on their capital with those who might subscribe at later periods, who would otherwise participate equally in advantages accruing from the early subscriptions of their more enterprising neighbors. This intention was equitable, and tended to induce early subscription, but does not meet the exigencies of the case.

The consideration of this clause has led to an inquiry into the policy of paying interest upon all subscriptions semi-annually in money, from the day the instalments are required to be paid, with a view not only of inducing subscriptions, but also of placing all stockholders upon equal ground. The objection that may be urged, that the Company will pay out as dividends that which it has not earned, will not bear the test of scrutiny.

It is perfectly true that the Company has earned no money to divide; but, whether the interest upon the capital paid in while the road is making is sunk, or appears only on the private books of the shareholders, or whether it is credited on the books of the Company on account of future instalments to be paid, or whether it is actually paid out, and new stock subscribed to meet the demand, the effect is the same. For in either case interest is an element in the cost of construction, and must be added to the capital expended. By this latter course, the effect produced is, that the capital stock, when the road is finished, represents exactly the cost, principal and interest, and every shareholder, early or late, is placed upon the same footing.

In considering this question, it is well to take warning from experience, and compare the practice in Pennsylvania with that of other States.

The large public works of this State, constructed by private means, it is believed, almost without exception, have been undertaken upon inadequate capital. Their projectors have raised sufficient funds by subscriptions for the commencement, and trusted to loans, at fixed interest, for the completion, hoping to obtain sufficient profit to pay off the debts and give excessive dividends to the shareholder.

The result of this policy has been almost universally a disappointment. The property of the stockholders, has, in many cases, been sacrificed to pay an interest to loan-holders. Money has been raised at usurious interest by the sale of bonds below their par value; and,

in cases where the works would have paid a fair remunerating profit if they had been constructed at their fair cash cost, they now labor under an accumulation of debt, which absorbs all the profit of the concern to pay the interest. Hence it is that capitalists in this city are backward in entering into new projects of public improvement, as their confidence in success and early returns is much shaken by the policy which has heretofore been pursued.

The example drawn from the practice here should be avoided, and the Pennsylvania railroad carried through upon its legitimate capital without debt, and this can only be accomplished by the payment of a moderate rate of interest to shareholders, during the progress of the work. Parties may not be found to the required extent who are willing, or able, to forego their income, while so large a work is in the course of construction, but if an income is regularly paid, any reasonable amount of capital may be obtained for a road which must, when finished, pay a remunerating profit.

It is fortunate that our work is of such a nature that it will not long require the exclusive use of capital to pay the interest, because every section, when finished, will bring in immediate returns in aid of the interest paid. A considerable profit will accrue when the road is in operation to Lewistown, and in another year, when it is connected with the State road at the Allegheny Portage, the income will be still further increased in proportion to the cost, and it is doubted whether the semi-annual payments for interest will ever prove a very serious burthen.

The line of policy now recommended by the Board is, to ask the passage of an amendment to the charter, requiring the Company to pay, semi-annually, an interest equal to six per cent. per annum upon all instalments as called for, (a charge of one per cent. a month being now provided upon delinquencies,) which interest is to be charged to cost of construction, and to credit the same account with all earnings until they amount annually to a sum sufficient to pay dividends to that amount.

In recommending the payment of interest, the Board do not propose any new experiment. This plan is sanctioned by the practice of English companies, as well as those of New York and Massachusetts, and has been followed by the most beneficial results.

Although it is understood that no provision exists in the charters granted in these States for the payment of interest, yet for the last six years such payments have been voluntarily made by all companies, under a conviction of the policy and equity of the measure, and it is found that it not only has the advantage of securing prompt payments from the stockholders, but it permits persons of limited means to invest in these stocks, with a certainty of receiving their incomes regularly from the time of such investment.

The ultimate effect has been that all the roads but one in Massachusetts have been built upon their capital stock, only a single company having been obliged to have recourse to loans, to complete their road.

In New York it is understood that the same course obtains, and that

the Hudson River Company pay to the shareholders an interest of seven per cent. as the work progresses.

In looking forward to the trade likely to accrue from an extension of the Pennsylvania road to the west, and in view of meeting the efforts that might be expected to divert that trade, the Board thought it expedient that a committee should visit Ohio during the past summer, in order that they might understand the interests that would probably be brought to bear upon their future prospects. Accordingly they delegated Messrs. J. R. Ingersoll, Ralston, Spangler, and Cresson, as a committee for this purpose. The report of that committee was highly satisfactory, and a correspondence was opened by them with intelligent and enterprizing citizens, interested in works of internal improvement in various parts of the State. From the inquiries of the committee, it is understood that an active spirit of enterprise has been awakened in that State, and that the most strenuous exertions are making to reach the Atlantic by railway communication.

The enormous increase of trade consequent upon the demand for provisions and bread-stuffs upon the Atlantic coast for shipment, has satisfied their citizens that channels of communication liable to interruption for a large portion of the year will not meet the demands of commerce, and hence their attention is turned to means of transportation upon which they can rely with certainty at all seasons.

Two great chains of railroad are contemplated through the State of Ohio, towards which decided measures have been taken. The first and most forward in its prospects, is that leading from Cincinnati through Columbus, and thence eastward till it touches the Ohio river at some point where it can connect with a railroad to the seaboard.

This road connects with the Cincinnati and Sandusky road, which is already in operation as far as Zenia, or Springfield, and passes through Columbus and Newark, to the mouth of Licking River. From this point two routes present themselves, one to Wheeling, through Zanesville, and the other in a north-eastern direction, till it strikes the river about Wellsville. The road, for a part of the distance, is in the hands of organized companies, who will carry on their work by local means, until they come to the point of divergence. This road is of too important a character to stop at such a point, as it will bring over it, for a large part of the year, most of the travel south of Cincinnati. Its movements from the mouth of Licking river must be governed by the probability of reaching the Atlantic in the shortest probable period. The tendency of trade from the country through which this road passes, is, from long habit, to Baltimore, a tendency created by the existence of the national road, and if, on arrival there, it shall be seen that the Baltimore and Ohio road is likely to reach the river first, the probability is in favor of the Wheeling route. If, on the contrary, it shall appear that the Pennsylvania road can first be finished, we may look with confidence to its being the recipient of that great trade.

In taking Columbus as the starting point, the distance estimated to Philadelphia is a few miles less than via Wheeling to Baltimore, and as the mass of travel tends to the north, the distance between Baltimore and Philadelphia is saved to the traveler. It is believed to be

a fact, that four-fifths of the through travel over the Baltimore and Ohio road take the line to Philadelphia without stopping at all in that city.

With such a prize as the southern Ohio trade in view, the energetic prosecution of the Pennsylvania road is of the utmost importance, as our success depends upon rapidity of motion. An additional argument is brought home to every stockholder to induce him to assist in placing the Company in a position to prosecute the western section simultaneously with the eastern.

Still more important to the interest of this road is the Central, or "Back-bone," line, as it is aptly termed, through the table lands of Ohio, which has been projected and is in a fair way of prosecution. This road will traverse, almost in a straight line, the rich belt of wheat lands which extends through the whole State, and embraces a fertile and thickly populated region, and crosses every railroad that can be made from the south to the lakes. The movements towards the construction of this road have already commenced with spirit and will be conducted with energy.

The country which it traverses is sufficiently populous and rich to make it, and, from the peculiar topography of that region, its cost will be moderate and its profits large. It is difficult to appreciate the extent of trade and travel that it will control. It commands a vast amount of trade which now finds its way to the lakes, and borders, for its whole length, the rich grazing country of the north of Ohio.

From its geographical position, this trade must come to Philadelphia, and may be looked to with confidence, both as a profit to our road, and an increase of the trade of the city. Already a portion of it from Wellsville, west, is under contract. Charters exist which will cover a large portion of the ground, and application will be made to the Legislature of Ohio during the ensuing winter to connect these charters, so as to give the whole line, from the eastern to the western borders of the State, into the hands of one company, who will at once commence their operations.

In view of the construction of these roads, which are destined at a very early period to throw upon the Pennsylvania railroad a trade of great magnitude and value, the Board turned their attention to the connexion which must be made between their western terminus and the Ohio State line, and being satisfied that the true policy of the citizens of Pittsburgh is to unite cordially, and with their whole strength in the completion of the road connecting the two cities, they took upon themselves the responsibility of guaranteeing to their fellow citizens of that city that this connexion should be made as soon as the requirements of the trade should make it advisable. And they still hope that the same view will be taken by our brethren of the west, and they will yet receive their hearty co-operation.

The Treasurer's report, herewith presented, will exhibit the state of the finances. Balance in hand, $953,303·86.

It is hoped that, with the new contracts about to be made, they will soon be able to expend these funds with rapidity. No calls will pro-

bably be made until the ensuing spring, of which due notice will be given.

The Board have to regret the loss from among their number of an ardent friend of the road, Henry C. Corbit, Esq., who was compelled to resign in the month of May, from ill health. The vacancy was filled by the election of Jesse Godley, Esq., on the seventeenth of that month.

In surrendering this important trust to their constituents, the Board cannot refrain from mutual congratulations upon the auspicious commencement and present prospects of a work destined, at no distant period, to form a main connecting line between the west and the Atlantic, and add largely to the trade and prosperity of the State and city.

All of which is respectfully submitted.

By order of the Board.

S. V. MERRICK, *President.*

Office Pennsylvania Railroad Co.,
Philada., 30th Oct., 1847.

The Treasurer Reports,

Amount received from stockholders in payment of

First Instalment,		$303,725·00
Second "		298,940·00
Third "		296,955·00
Fourth "	in advance,	50,815·00
Fifth "		640·00
Sixth "		200·00
Seventh "		100 00
Eighth "		50.00
Ninth "		50·00
Stock in full,		66,250·00
		$1,017,725·00

And *expended in*

Organization and Expenses,	$10,518·99	
Engineering,	23,116·11	
Graduation,	10,166·02	
Real Estate,	1,575·00	
Right of Way, Fencing, and Damages,	5,413·15	
In hands of Agents,	13,631·87	
		$64,421·14
Balance in hands of the Company,		$953,303·86

GEORGE V. BACON, *Treasurer.*

Philadelphia, October 30, 1847.

The following communication from the Chief Engineer is appended:

ENGINEER DEPARTMENT PENN'A RAILROAD,
Dec. 1st, 1847.

SIR:—In consequence of the lateness of the season at which the surveys for the Pennsylvania railroad were commenced, it will be out of my power to furnish, at this time, a satisfactory description and estimate of any considerable portion of the route. I should, therefore, prefer deferring a detailed report of our operations for a few months, when the estimates, founded upon the surveys now about closing, will be made out.

I can, however, state, for the information of the Board, that we have —within the short space of four months from the time the parties took the field above Lewistown—determined the route of the whole of the eastern division of the road. The surveys made have been very extensive, and are entirely satisfactory and conclusive in their results; leaving no doubt upon my mind in relation to the superiority of the route selected. Indeed, a better line than we have obtained could scarcely have been expected. The whole distance from Harrisburg to the foot of the Alleghenies is 134 miles, and upon this distance, the maximum ascending gradient to Lewistown does not exceed sixteen feet per mile, or descending eight feet; and above that place the greatest ascent per mile is 21 feet, and descent 10½ feet.

The foot of the Alleghenies is reached at Robinson's Summit, on the ridge dividing the Frankstown Branch and Little Juniata river, west of the Brush mountain. From this point, the great barrier separating the east from the west, can be ascended by a continuous gradient of 80 feet per mile, for 12¾ miles, without encountering any very extraordinary difficulties, overcoming an elevation of 980 feet, and passing to the west side of the mountain, at Sugar Run Gap, by a tunnel 760 yards long and 160 feet below its apex. This gradient is less than the maximum ascent used on the Boston and Albany railroad, and also on the Baltimore and Ohio railroad, at the ridge between the Patapsco and Potomac. It may be reduced to 75 or 76 feet per mile by a longer tunnel at the mountain summit, and a slight prolongation of the gradient eastwardly.

From Robinson's Summit, a connexion can be effected with the Allegheny Portage railroad by a branch of six or seven miles in length, over favorable ground. This connexion should be made simultaneously with the main line, if the Commonwealth should appropriate the means necessary to place the Portage road in a condition to do the additional business that we will throw upon it.

The maximum gradient best adapted to the western division has not yet been determined, but it is believed that it cannot be advantageously reduced below fifty feet per mile. One line has been located through from Pittsburgh to Blairsville, via Turtle Creek, the profile of which, by the use of a higher gradient and a more minute examination of the country, has been greatly softened in its asperities over that made from Mr. Schlater's surveys. Three of the tunnels recommended by him have been dispensed with. Another route, by

the valley of Brush Creek, passing through Greensboro', and intersecting the Conemaugh at the point of Chesnut Ridge, is being located, which, though longer, does not present quite so rough a surface as that by Blairsville.

The distance from Harrisburg to the summit of the Allegheny is 146 miles, thence to Pittsburgh it will be about 104 miles by the Conemaugh and Blairsville, and 96 miles by the Blacklick and Blairsville route, making the total probable distance, on the shortest route, from Harrisburg to Pittsburgh 242 miles.

The whole line will be admirably arranged for cheap transportation, not only on account of the adaptation of the gradients to the direction of the heaviest trade, but also from the steeper gradients occurring where fuel will be unusually cheap; bituminous coal abounding upon their whole extent, and may be obtained at from 60 to 90 cents per ton. The mountain gradient divides the eastern and western divisions of the road, and the low from the higher system of gradients—up this steeper inclination the trains, when heavily laden, will be assisted by additional locomotive power.

The contracts entered into for 20 miles of the graduation on the eastern division, in July, have all been commenced, and it is believed that all, except that including the Susquehanna Bridge, will be finished by the time allotted. The latter is now progressing with much vigor. Upon the western end, but few of the contractors have commenced their work; ample time having been allotted them to complete their contracts, it has not been deemed necessary to push them.

Very respectfully,
Your obedient servant,
J. Edgar Thomson, *Chief Engineer.*

To S. V. Merrick, Esq., *President.*

Annual Report of the Managers of the Union Canal Company of Pennsylvania, to the Stockholders, Nov. 16, 1847.

Since the last annual meeting of the stockholders, several very favorable changes have taken place in the affairs of the Company. At that time some of the loanholders, having refused in writing to agree to the consolidation of the loans with the stock, prevented the removal of the assignment by which all the property of the Company was placed in the hands of a trustee. Last spring the Managers succeeded in getting these loans converted into stock, and the property restored to the hands of the Company. The capital now consists of 13,511 shares of

$200 each, amounting to	$2,702,200·00
And fractions of shares amounting to	42,421·40
Making the entire capital,	$2,744,621·40

The debts secured by the deed of trust, for steam engine, interest due to loanholders prior to assignment, &c., have been paid, thus leaving the Company entirely free from debt.

Extensive repairs and renewals of mechanical structures have been made during the past year; a large portion of the summit level has been relined; nearly the whole of the feeder leading from the water works has been rebuilt; the railroad has been relaid with heavy flat bar iron; several aqueducts have been renewed; a new house for the weighmaster at the water works, and a lock-house on Branch canal, have been erected.

The canal continued open until the 5th of December, when it was closed by ice. The navigation in the spring began on the 30th of March, (having been delayed by the completion of repairs,) and has continued uninterrupted since then, with the exception of a short distance at the eastern end, for a few days, occasioned by a flood of unusual height, and the Branch canal during the same period, the navigation of which was rendered dangerous, if not impracticable, by the height of the water.

The trade on the canal has increased very much the past year, as will be seen from the following table; the tonnage this year exceeding that of any previous one by 688 tons, although the tolls are not so large:—

Years.	Tons.	Tolls received.	Av. rate per ton. Cts.	mills.
1828	18,124	$15,512	·85	5
1829	20,522	16,676	·81	3
1830	41,094	35,133	·85	5
1831	59,970	59,137	·98	6
1832	47,645	59,061	1·23	9
1833	85,876	103,462	1·20	5
1834	84,536	119,870	1·41	8
1835	118,978	135,254	1·13	7
1836	117,136	133,025	1·13	6
1837	110,032	107,590	·97	8
1838	126,870	123,575	·97	4
1839	138,568	135,163	·97	5
1840	115,292	110,855	·96	1
1841	83,624	66,601	·79	7
1842	83,106	57,477	·69	2
1843	76,959	53,538	·68	2
1844	79,871	56,580	·70	8
1845	102,593	60,036	·58	5
1846	114,920	62,682	·54	5
1847	139,256	91,356	·65	6

The Pine Grove coal trade has also steadily increased, but yet slowly, as is shown by the statement below:—

Years.	Tons.	Years.	Tons.	Years.	Tons.
1833	3,500	1838	15,000	1843	22,000
1834	6,911	1839	20,885	1844	29,000
1835	14,000	1840	20,500	1845	35,000
1836	12,000	1841	19,500	1846	55,500
1837	17,000	1842	32,500	1847	60,499

Another coal field, on Fishing Creek, may be brought into operation by constructing a railroad for a few miles; and, by continuing it through the Fourth mountain by a tunnel, Williams' Valley may be opened to the Union canal. A new market for coal has also been opened at Lebanon, where one anthracite furnace has been blown in during the past year, and another stack is now nearly completed. There are other points, also, on the Union canal, advantageously situated for the iron business, and which will probably, ere long, be occupied by furnaces and other works.

The foregoing considerations naturally lead us to a matter of great importance to the Company, viz. the enlargement of the Canal. The subject was introduced last year to the meeting of stockholders by resolutions appended to the annual report, but was not then acted upon. The Board desire again to call the attention of the stockholders to this important matter, and to ask such action by them as will secure the enlargement of the entire line at an early date. At present, nearly the whole trade of the Susquehanna and its tributaries is diverted from its natural channel through Pennsylvania, to a circuitous route through two neighboring states, and to the obvious injury of this Company. The trade of the Susquehanna is annually and rapidly increasing, and is now so large that it can be with difficulty passed by a single set of locks. The boatmen are anxious to have the Union canal enlarged to accommodate the Susquehanna and Juniata boats, on account of the safety, cheapness, and healthiness of the route; while the Schuylkill Navigation Company would be benefitted by the increased tolls, and the property owners on the Schuylkill would receive a corresponding advantage by bringing the trade again to the western front of the city.

The Managers believe that the Company has already obtained all the legislative action necessary. They are authorized to increase their capital stock, or to borrow money, and secure the same by mortgage of the property and franchises of the Company. Surveys of the canal have been made, and estimates of the cost of enlargement. Nothing is now wanting to accomplish it but the determination of the stockholders to do it, and the money for paying the cost. Some kinds of trade cannot be obtained so long as the canal remains of its present dimensions, and there is an unwillingness to build boats of 30 tons burthen, when there is a prospect of their being thrown out of use in a few years. This consideration should bring the stockholders to an early decision of the question, whether the canal is to be enlarged, or to remain of its present size.

An inconvenience now exists, occasioned by the time of closing the financial year of the Company on the 31st of October. The trade continues for some weeks after that date, and thus the business of parts of two years are included in our statements. It may be worthy of consideration, whether it would not be advantageous to have the time of closing the accounts changed to December 31st, and that of holding the annual meeting for electing officers to February. A change of the par value of shares might also be advisable to make them correspond with those of other companies.

The Managers would conclude their report by proposing the following resolutions for the consideration of the meeting:

Resolved, That the Managers of the Union Canal Company be and they are hereby authorized, to take such measures as may be necessary to procure the requisite means for enlarging the canal, or any portion thereof, to the size of the Pennsylvania canal, either by a new issue of stock, or by loan, or in such other manner as they may deem expedient.

Resolved, That the Managers be requested to make application to the Legislature for power to change the time of closing the accounts of the Company, and of holding the annual meeting of stockholders, and also for dividing the shares of the capital stock into shares of fifty dollars each.

The Treasurer's accounts of receipts and expenditures, together with a table showing the tonnage which has been transported on the canal during the past year, are herewith presented.

By order of the Board.

ROBT. B. DAVIDSON, *President.*

Philadelphia, Nov. 16th, 1847.

Statement of the Tonnage which passed the Union Canal, from Nov. 1, 1846, *to Nov.* 1, 1847.

	Tons.	Cwt.	Qrs.
Flour, 23,470 barrels,	2,200	6	1
Grain, 342,176 bushels,	8,707	2	3
Iron,	8,202	9	3
Iron Ore,	9,512	18	2
Anthracite Coal,	62,549	8	0
Bituminous Coal,	2,702	7	0
Charcoal,	258	15	1
Lumber, 25,010,994 feet,	25,233	16	0
Shingles, 6,869,193,	3,066	12	0
Whiskey, 337 barrels,	45	3	1
Salt, 40,416 bushels,	1,687	17	2
Tobacco,	76	7	0
Plaster,	1,793	7	1
Lime, 43,056 bushels,	1,537	14	1
Limestone,	3,313	15	1
Seeds,	58	2	0
Leather,	66	6	0
Butter,	57	12	2
Nails,	13	8	0
Fish, 2204 barrels,	299	13	0
Merchandize,	550	1	0
Cordwood, 2782 cords,	3,725	17	3
Sundries,	4,197	18	2
	139,256	18	3

139,256 tons, 18 cwt., 3 qrs., of 2240 lbs.

Mr. Samuel's Railway Express Engine.—Light Engines for light weights.

To those who can read the signs of the future in the indications of the present, last Saturday was an epoch in railway affairs; for, on that day, "thought became a fact," pregnant with consequences. On that day, the resident engineer of the Eastern Counties' Railway, by the aid of *twenty-two hundred weight* of metal, timber, fuel, and water, conveyed seven persons from London to Cambridge, at the rate of 40 miles per hour—a feat which, up to that period, could only be accomplished by putting in motion *thirty tons* of inert matter. To those who ask the *cui bono?* we reply that it is an indication of a reduction in the working expenses of railways, by the diminution of dead weight—an indication of increased durability of rails and roadway, and reduction in the cost of maintenance of way—an indication of greater speed than has yet been attained, and at a lessened cost—an indication of yet cheaper transit to the community, with increased profit to the shareholders—an indication of the extended use of railways, in many modes not hitherto dreamt of—an indication that steam carriages on railways may be advantageously applied to many purposes for which steam tugs (the existing locomotives) are not well adapted—and more than an indication, a direct offer, by authority, to the periodical press, to forward their reporters and messengers to the various scenes of their labors, on future occasions, at a cost of one-fourth the price hitherto charged. This is no merely curious experiment, but practical everyday business. Several pounds per day is the cost of an ordinary locomotive—fewer shillings is the cost of this new candidate for passenger transit. And be it remembered that this first "steam carriage" on railways, satisfactory though it be, still lacks the improvement of experience. The amount of improvement in the second of its class we cannot yet pronounce upon; but it is calculated that two tons of matter will convey twenty passengers, in a closed carriage, at the rate of sixty miles per hour; 40 cwt. of dead load to 30 cwt. of available load, or duty. And, after that experience be gained, it is probable that the third carriage will, with a dead load of 60 cwt., convey sixty passengers, or 90 cwt., for the dead load will diminish in proportion to the number of passengers.

A stage-coach of former times weighed about 1 ton; the four horses and harness, about 1½ tons—50 cwt.; guard and coachman, 3 cwt.; total, 53 cwt. By this apparatus, 17 passengers were carried at a rate of 10 miles per hour—about 24 cwt.,—so that 2 cwt. dead load carried 1 cwt. available load.

An engine, tender, three first, and six second class carriages, with driver, stoker, and guards, weigh about 70 tons on the Eastern lines. They will carry 192 passengers, at the rate of 30 miles per hour—about 288 cwt. of available load to 1,400 cwt. of dead load, or about 5 cwt. dead load to 1 cwt. available load.

A Great-Western express train weighs about 70 tons. The passengers, 128 in number, weigh about 9½ tons, which will be near 11 cwt. dead load to 1 cwt. available load.

The Eastern Counties' steam-carriage weighs 22 cwt., and carries 7 passengers, weight 10½ cwt.; about 2 cwt. of dead load to 1 cwt. of available load. This is about equivalent to the old stage-coach, in proportion of materials, at quadrupled speed.

But if, at a future time, 3 tons of dead load will carry 4½ tons of available load, that will be the proportion of 1 cwt. of dead load to 1½ cwt. of available load.

It is not possible that principles of so great importance should be suffered to lie in abeyance; and we think that the Directors of the Eastern Counties' Railway have shown great clear-sightedness in sanctioning their engineer, Mr. Samuel, in so important an experiment. We foresee numerous purposes to which these steam-carriages may be applied, and shall be much surprised if the Post-office do not grapple at once with so cheap a means of rapid transit: and we shall also be surprised if it does not induce the Directors to institute inquiries and experiments as to what amount of power is actually generated in their engines, for the purpose of overcoming their own friction. The result of this novel vehicle is most creditable to all the parties concerned. We believe that Mr. Samuel was the original propounder of it, for the Eastern Counties' Railway; and, when sanctioned by the Directors, the working drawings were made, under his superintendence, by his then assistant, Mr. Reynolds. It was constructed by Messrs. Adams, of the Fairfield Works, and we shall be glad to witness the launching of the second of its class from the same establishment.—*Railway Record, Oct. 30th.*

London Mech. Mag.

AMERICAN PATENTS.

List of American Patents which issued in the month of October, 1846,—with Exemplifications, by CHARLES M. KELLER, *Agent for procuring Patents, and late Chief Examiner of Patents in the U. S. Patent Office.*

1. For a *New and Useful Self-acting Mule for Spinning Cotton and other Fibrous Substances;* William Mason, Taunton, Massachusetts, October 3.

The patentee says,—"The motions of the mule may be divided into three series, which are subdivided in the action of the apparatus. The first series consists in the drawing out of the carriage, the revolving of the drawer rollers, and the whirling of the spindles, by means of which series of motions the rovings are drawn out and the threads spun and twisted. The second series consists of backing off, as it is termed; that is, turning the spindles the reverse direction, to uncoil the threads from the points of the spindles to the cops, and turning down or depressing the front faller; at the same time, to place all the parts in a proper condition for the third series of motions, which con-

sists of putting or running in the carriage, winding on the yarn or threads, by giving a varying motion to the spindles corresponding to the form and size of the cops, and operating the faller to give the proper shape to the cops.

"The first series of motions is regular. The carriage is drawn out by a regular motion, effected by a train of wheels from the driving pulley to a line shaft, which carries endless chains connected with the carriage at different parts of its length to insure steadiness of motion. During this, the draw rollers are rotated to give out the staple as it is spun by another train of wheels, deriving motion from the same source as the preceding, and in manner substantially similar to other mules; and, at the same time, the spindles are whirled or rotated by a band, receiving motion from a pulley on the shaft of the driving pulley, as in other mules. This completes the first series of motions, in which I claim nothing new.

"At the end of the first series of motions, the threads that have been spun are coiled on the spindles from the cops to their points; it is therefore necessary to uncoil them, (called backing,) preparatory to winding on, and at the same time to depress the front faller, to place it in a proper position for winding on. The second series of motions effects these purposes, and the various parts of the mechanism are put in a proper condition to effect this by the momentum of the moving parts at the end of the first series of motions. This constitutes the first part of my invention. As the carriage approaches the end of the out motion, the driving belt is shifted from the first driving pulley to a loose pulley by the side of it, to permit the momentum of the moving parts to complete the movements; and so soon as these are accomplished, a balance weight is carried beyond the vertical line, and falls over, which shifts the belt from the loose pulley to a second fast pulley on the same shaft with the others; at the same time, the trains of wheels that operate the carriage and the draw-rollers are liberated by the shifting of a clutch, and at the same time a friction clutch is brought into action, thereby connecting the band that drives the spindles with a sliding rack, (called the 'top-sliding rack,') which, in consequence of this connexion, is carried by the momentum of the spindles sufficiently far in one direction to give by its return the required motion to the spindles in the reverse direction, to uncoil the threads from the upper part of the spindles. Whilst the rack is thus moved, the second fast pulley sets in motion, by a train of wheels, a crank pin that works in a slot in a connecting rod, and this crank pin, when set in motion, is a little below a line passing through the connecting rod and the axis of motion, so that the crank pin moves a short distance before it begins to move the connecting rod; this period of time is sufficient to permit the momentum of the spindles (as above stated) to draw the sliding rack to the distance required, to be in a condition, by its return movement, to give the 'backing-off' motion to the spindles. The crank pin, then, in making a semi-revolution, carries the connecting rod with it; and this being in connexion with the lever of a rock-shaft, provided with a toothed pulley, around which passes a chain attached to the end of the sliding rack, draws it (the rack) for a short

distance in a reverse direction, and thus causes it to give the backing-off motion to the spindles, to uncoil the threads, at the same time depressing the front faller to bring the threads in a proper position for winding on; this latter being effected by having one end of the shaper or coping rail jointed to a lever on the rock shaft above mentioned. The chain attached to the rack, and which communicates motion to it, is kept tight by being passed over a pulley and having a weight suspended to it. When the top sliding rack is carried forward by the momentum of the spindles, at the end of the first series of motions it is gradually arrested, and with it the spindles, by means of a spring brake of a peculiar construction, viz: On the rock shaft there is a bent lever, to one end of which is connected a helical spring, also attached to an arm jointed to the other end of the bent lever; and by the side of and attached to the toothed wheel, around which passes the chain on the end of the sliding rack, and which turns freely on the rock shaft, there is a ratchet wheel, and by the side of it a cam-plate provided with a hand or catch, by means of which the ratchet and toothed wheels are carried around, when the cam-plate is carried around, by the action of the spring brake on the cam-form of its periphery. And when this has been carried far enough round, the catch is liberated, to permit the return of the parts, by means of an arm or lever jointed to one end of the bent lever, which is made to lift the catch from the teeth of the ratchet wheel. As the cops increase in diameter, it is evident that the backing-off motion must be diminished, and this is effected by making the connecting rod above mentioned in two parts, the first connected by one end (as above stated) with the crank pin which actuates it, and which works in a slot to give motion to the rod in one direction only, (the crank being then at liberty to turn without imparting any motion longitudinally to the rod,) and the other end being jointed to a curved arm, that vibrates on a steel pin, and the other part of the connecting rod is jointed to the arm of the rock shaft, and to a slide that works in a curved groove in the vibrating arm, so that, as this slide is moved from or towards the axis of motion of the arm, the rock shaft will be vibrated more or less; and this slide is moved in or out by being in connexion with the mechanism that operates the motions of the coping rail, and which, therefore, will be described under the third series. At the end of the backing-off motion, the vibrating arm of the connecting rod is hooked and held by a catch until the carriage is run up, and then liberated to permit the parts to resume their appropriate positions preparatory to a repetition of the operations.

"At the end of the second series of motions the third series of motions commences, and these constitute the second part of my invention. The carriage is run in by a crank motion, which has the effect to gradually start it from a state of rest and accelerate its motion to the middle of its course, and then gradually diminish its motion until it is brought to a state of rest; thus avoiding all tendency to break the threads consequent upon all sudden motions. This is effected in the following manner, viz: When the shipping lever is operated at the end of the first series of motions, a clutch on a shaft carried by a sec-

ond fast pulley is shifted; and as this clutch has but one tooth, the shaft is thereby permitted to make part of a revolution, during which the second series of operations takes place before it (the clutch) begins to act, and then it communicates motion to a large cog wheel provided with a crank pin, that actuates a connecting rod jointed to a rack, (below the top-sliding rack above described,) the teeth of which take into the teeth of a pinion on the shaft of one of the train of wheels that communicates motion to the carriage, thereby imparting the desired movement. The winding on of the yarn during the running in of the carriage is effected by the top sliding rack, which for this purpose is carried by the rack just described, by means of such connexions as admit of modifying the motions of the top sliding rack, which drives the spindles in winding on. Motion is communicated from the bottom to the top rack in the following manner: On the end of the lower rack, and by the side of it, there is a stud-pin on which turns a scroll cam, and to that part of its periphery which is nearest the axis is attached one end of a chain, which passes from thence around a roller that turns on a stud-pin at the side of the lower rack, and is then carried back and attached by a short arm to the top sliding rack, so that when the lower rack slides, the top rack will move with it, provided the scroll cam remains immovable on its axis; but the motion of the top rack, during each operation, must have a motion accelerated relatively to that of the lower rack, to increase the rotation of the spindles as the threads are wound round on a gradually diminishing diameter of the conical form of the cops. This is effected by causing the scroll cam to turn on its axis during the motion of the rack, by having a wheel attached to and turning with it, to the periphery of which is attached one end of a chain that passes round it, and is attached by the other end to another part of the machine, so that, if this part of the attachment remains fixed, a regular accelerated motion will be given to the top rack relatively to the motion of the lower rack, and necessarily the spindles will have their rotation accelerated relatively to the motion of the carriage. These relative motions of the two racks, as described, are such as are required after the base of the cops has been formed, for then the threads are wound regularly on a cone; but in forming the base of the cops the first winding is on the naked spindles, at which time the motion of the spindles should correspond with that of the carriage; and from the commencement until the base is formed, the accelerated motion should be gradually brought into play to give the conical form to the cops. This is effected by having the chain that winds on the wheel that turns with the scroll cam attached to a slide that works on a screw in a vibrating arm, the outer end of which is jointed to another arm of equal length that turns on the end of the stud on which the scroll cam and wheel turn, so that when the slide is at the lower end of the arm—the two arms being of equal length—the motion of the wheel with the rack will not cause it to wind up the chain, but, as the slide is drawn up towards the axis of vibration of the arm, one end of the chain will necessarily move through a less space than the other, and thus cause the wheel with the scroll cam attached thereto to turn on

its axis, and thus to vary the motion of the top rack, and thereby adapt the motion of the spindles to the varying diameter of the base of the cops. The screw in the vibrating arm that carries this slide is in connexion, by means of appropriate cog wheels, with a horizontal ratchet wheel, which is free to move when the arm vibrates in one direction, but held by the hand or catch when the arm vibrates in the reverse direction, for the purpose of turning the screw to move the slide; and this hand or catch is governed by an apparatus called a butterfly, which is acted upon by an arm from the counter faller when the tension of the threads is too great, and thus throws the hand into the teeth of the wheel, that the vibration of the arm shall operate the slide, the hand or catch being disengaged at each running out of the carriage. The last of the third series of motions is the operation of the coping rail for operating the faller, which, being essentially similar to others, needs no special notice here.

"At the end of the running-in motion of the carriage, a pin, on an arm projecting from the shaft of the crank that operates the under rack, liberates the catch that holds the connecting rod, by which the backing-off motion is effected; and so soon as it is liberated, the weight of the machinery attached draws it back; and to prevent any sudden jar by this operation, the crank pin which operates the connecting rod in one direction is so governed in its revolutions as to be nearly a semi-revolution from its point of departure at the commencement of the backing-off operation, so that the force required for carrying it back to this position is sufficient to ease off the motion of the returning parts. This crank pin is held in the position just indicated by a brake within the second fast pulley, and this brake is connected, by a joint link and lever, with the arm of the connecting rod of the backing-off apparatus, which, when drawn back, forces the brake in contact with the pulley, and arrests the train of wheels and this crank pin in their appropriate place.

"When finishing the cops, it is important to wind the threads on tight at the point, particularly as the upper ends of the spindles are tapering. This is effected by forming the connexion between the chain and the end of the top sliding rack by means of a vibrating frame, from which projects another arm, that has a chain jointed to it extending to and winding on an arbor, which arbor has a ratchet-wheel on it, which is carried a part of a revolution at each operation of the mule by a hand on the arm of the connecting rod of the backing-off motion; and this auxiliary chain is of such length that it continues to be wound upon the arbor without affecting the operations of any part of the machinery until the cops are nearly completed, and then it becomes so short as to be brought in contact with a permanent arm towards the end of the winding-on operation; and when thus brought in contact with this arm, it suddenly shortens the chain that forms the connexion between the two racks, and necessarily increases the rotation of the spindles, which, as a necessary consequence, draws the threads tighter on the spindles."

Claim.—"I have thus described the general character of my invention, and the manner of constructing and using the same; but before

pointing out what I claim as my invention, I wish it to be distinctly understood that I do not limit myself to the precise form and construction of the various parts employed, nor to the precise arrangements described, as I consider all mechanical equivalents as within the limits of my invention; what I claim, therefore, as my invention, and desire to secure by letters patent, is—

"1st. The disconnecting of the mechanism employed in running out the carriage and turning the draw rollers from the mechanism, which gives the whirling or spinning motion to the spindles when the driving power is shifted from these, the first series of motions, to enable the spindles to continue their motion by inertia, independent of the other motions, by means of the clutch box, (or its equivalent,) which forms the connexion between the three movements constituting the first series of motions, whereby the momentum of the spindles can be employed for preparing the parts for the backing-off motion, substantially as described.

"2d. The method of preparing the parts for the backing off motion, by means of the momentum of the spindles, by connecting them with the backing-off apparatus by means of the friction clutch, or any equivalent therefor, substantially as described.

"3d. The backing-off apparatus, consisting of the combination of the top sliding rack, which communicates motion to the spindles; the rocking shaft, with its cam and spring brake, and other appendages, and the connecting rod, operated by the crank; all substantially as described.

"4th. The method of decreasing the backing-off motion to correspond with the increased length of the cops, by means of the slide in the intermediate arm of the connecting rod, (between the two sections of the connecting rod,) by means of which the rocking motion of the rock shaft is gradually decreased, substantially as described.

"5th. Combining the train of wheels which actuate the backing-off motion of the carriage by means of a clutch, substantially as herein described, which admits of the necessary backing-off motion before the tooth of the clutch starts the carriage, whether this be effected by a clutch, or by any other means, substantially the same.

"6th. Running in the carriage by means of a crank motion, which actuates a sliding rack that communicates the desired motion to the carriage, so as to start and arrest it gradually, substantially as described, to avoid any sudden strain or jar upon the threads.

"7th. The method of communicating the winding-on motion to the spindles from the main rack, which runs in the carriage, by combining the said main rack with the top sliding rack by means of a chain and scroll cam, or their equivalents, by means of which combination, in connexion with the form of the cam, the motions of the spindles so correspond with that of the carriage as to wind the thread on the conical forms of the cops, as described.

"8th. The method of varying the winding-on motion of the spindles, to form the base of the caps, by means of the slide and chain, which vary the motions of the wheel that is attached to and which rotates the scroll cam, substantially as described, whether the slide be oper-

ated by the vibration of the arm on which it slides, or by any other means, substantially as herein described.

"9th. The method of regulating the motion of the slide that varies the motion of the scroll cam of the winding-on motion, by means of what is termed the butterfly and its appendages, when this is acted upon by the counter faller, operated by the tension of the thread, substantially as described: and

"10th. The method of winding-on the threads tighter at the points of the cops, when finished, than by means of the apparatus which gives to the top sliding rack an increased motion towards the end of the operation; the said apparatus consisting of a chain, which is connected with the chain that forms the connexion between the main and top rack, and which is gradually wound up, and strikes against an arm towards the end of the operations of the mule to shorten the connexion between the two racks, and thus increase the winding-on motion of the spindle, as described."

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2. For an *Improved Self-Feeding Straw Cutter;* James T. Wade, Augusta, Georgia, October 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the brushes with the gauge boards, vibrating frame, and cutting blade, substantially in the manner and for the purpose herein set forth."

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3. For an *Improvement called "the Inclined Piston;"* James Richards, New York, October 3.

Claim.—"What I claim as new in my invention, and desire to secure by letters patent, is the use and application to pistons of the three or more inclined elastic wings, breaking joints, and fitted to each other as described, of cast iron, or any suitable material, working out the principle I have above mentioned, and combined together, and with a piston bulkhead and follower, or any substitutes for them, and working together in manner substantially as above set forth and made known."

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4. For an *Improvement in Looms for weaving Ribbons, and other narrow stuffs;* Carl V. Ganahl, (assignor to Francis V. Ganahl,) Junsbruck, Austria, October 3.

The patentee says, "The nature of my invention consists in constructing a loom for weaving ribbons and other narrow goods, which can be driven with great rapidity, by steam or other power, requiring only one person to tend 20 to 50 stands, all of which are driven by one axle, as there is a regulator and stop attached to each stand."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the pickers constructed as above described, and also their combination with the lathe, in the manner and for the purpose herein set forth.

"Secondly, I claim regulating the take-up motion, by means of a roller which rests against the cloth beam, acting on an upright rod, with a gauge thereon to curtail gradually the motion of the pawl, and thus decrease the distance the cloth beam turns as it enlarges, constructed and combined substantially as herein made known.

"Thirdly, I claim the combination of the jacquard, constructed as above described, with the upright rods, in the manner and for the purpose before specified.

"Lastly, I claim the apparatus for stopping the loom—that is to say, the forked lever, arms, eccentric, hook, catch, and upright bar—constructed and arranged as herein described, in combination with the shipper for casting off the belt and stopping the loom."

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5. For an *Improvement in the Glass Furnace;* Deming Jarvis, Boston, Massachusetts, October 3.

Claim.—"What I claim as my invention and improvement, is extending the fire-place and flame chamber entirely around, and so as to encompass the melting pot, in the manner substantially as above described, instead of placing the fire-place entirely on one side of the pot, as is the custom in ordinary glass furnaces."

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6. For an *Improvement in Threshing Machines;* Walden Eddy, Duchess county, New York, and John A. Toplin, Washington county, New York, October 3.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the mode of inserting the teeth in the cylinder to threshing machines, in combination with the manner of making the threshing cylinder in several sections of cast iron heads, the whole constructed and operating in the manner and for the purpose herein before described."

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7. For an *Improved Stove for Cooking and Warming Apartments;* Adam C. Conde, Schenectady, New York.

The patentee says,—"My stove, in its general construction, is similar to many other cooking stoves. It has two ovens, one of them placed above the other, with a flue space between them; but this flue space, and one in front of the two ovens, and at the back of the upper oven, do not admit any portion of the draught from the fire chamber, but used for the passage of air that is heated by the action of the fire through the back plate of said fire chamber, and the air so heated is to be subsequently conducted through suitable tubes to the apartments which it is desired to heat. The draught direct from the fire is conducted to the exit or smoke pipe, through flues especially appropriated to that object."

Claim.—"Having thus fully described the manner in which I construct and arrange the flues of my air-heating stoves, what I claim therein as new, and desire to secure by letters patent, is the particular

manner of arranging the air-heating flues in front of, between, and behind the ovens, in combination with the flues for carrying off the gaseous product of combustion, the whole arrangement and combination being substantially the same with that herein made known."

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8. For an *Improved process and apparatus for the Manufacture of Lenses;* Henry M. Paine, North Oxford, Massachusetts, October 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the combination of the furnace and fusing oven, in the manner described.

"Second, the construction of the "curvator," with its guides, substantially as herein set forth.

"Third, the process by which any required parabolic form or curvature may be given to the lens, as herein set forth in detail."

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9. For an *Improved machine for cutting Laths;* James M. Winslow, Campbellsport, Ohio, October 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of arranging the bearings of the feed roller in plates fastened to the outsides of the central posts, in combination with the revolving pointed feed roller, eccentric rack, and revolving pinions, for raising and feeding the logs to the knives."

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10. For an *Improved Stock, for the neck;* Charles Fanshaw, New York, October 3.

Claim.—"What I claim as new, and of my invention, and desire to secure by letters patent, is the introduction and application of an elastic, metallic, or other band, to a stock frame for the neck, for the purpose as herein substantially set forth."

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11. For *Improvements in the Manufacture of Gas;* George Michaels, Paris, France, October 3.

Claim.—"Having thus described the invention, and the best means I am acquainted with for performing the same, I would have it understood that what I claim is the hereinbefore explained improvement in the manufacture of gas from anthracite or other equivalent, for the purpose of lighting or heating; the same consisting in the employment of a *closed* furnace, (constructed and combined with a gasometer, as described,) and streams or jets of heated steam and air forced into the charge thereof in a state of combustion, all in the manner as above specified.

"I also claim the peculiar manner of increasing the illuminating power of the gas, (generated as above,) through the agency of oil or turpentine, or other equivalent matter, by causing the gas to pass through the olefiant fluid, and be impregnated by it essentially as set forth."

12. For *Improvements in the manufacture of Sugar from Cane or other Plants;* George Michaels, Paris, France, October 3.

Claim.—"Having thus described my discovery, I shall claim my heretofore specified improved manner of preparing the canes or saccharine plants, treating them and extracting the sugar by dissolution; the same consisting in cutting the canes or plants transversely through their saccharine cells, and into very thin slices, immersing them in hot water, and rendering insoluble and inert, during the process of dissolution, such chemical substances of the cane as would otherwise exert an injurious influence or chemical action upon the saccharine matter.

"I shall claim the use of oxalate of alumina, as above set forth, for the purpose of exerting the necessary chemical action upon the aforesaid combination of sirop; chlorophyle, and the superabundance of lime, in order to remove these two substances, and particularly the lime, that extraneous chemical matter used to render inert these substances, which would otherwise prove injurious to the sugar during the process of its dissolution from the cane, as described."

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13. For *Improvements in Clocks;* John M. Schrock, Millersburg, Ohio, and John G. Fischer, Quincy, Illinois, October 3.

We omit the claim, because of its dependence on the drawings.

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14. For an *Improved Machine for Gathering Fruit;* William Sedgwick and John Brooks, Poughkeepsie, New York, October 3.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the elastic fingers and sliding ring, arranged and operated in the manner and for the purpose set forth, whether constructed precisely in the manner described, or other mode substantially the same. Also, a pair of shears or cutters attached to the instrument on the top, or otherwise placed, for the purpose of cutting off the stem of the fruit if desired; said shears being closed by the closing of the elastic fingers. Also, the flexible hose for conducting the fruit, as set forth, in combination with the apparatus for gathering it, operated in the manner set forth."

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15. For an *Improved Crimping Tool, for crimping boots;* William Taylor, Berlin, New York, October 3.

The patentee says,—"The nature of my invention consists in causing the leather to conform to the shape of the crimp, by forcing the latter, after the leather has been applied thereto, between two smooth iron jaws of peculiar shape, the interval between said jaws being regulated by a screw; a second screw acting against the heel of the crimp, and serving to thrust the instep thereof, and the parts adjacent thereto, between the jaws, as before mentioned."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the adjustable metallic jaws attached to the iron bars connected with the cross head, with the fol-

lower actuated by a screw passing through the cross head, and serving to thrust the crimp, with the leather thereon, between said jaws; the whole forming a hand tool, and being constructed and operating substantially as herein described."

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16. For an *Improvement in Straw Cutters;* William J. Rylander Columbus, Georgia, October 3.

The patentee says,—"The nature of my invention consists in forming and hanging the knife of a straw cutter so as to cut with a diagonal down stroke, across the box, giving the most effective application of the knife to the purpose for which it is designed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the knife, constructed in the manner described, in combination with the manner of working the same, so that it shall cut down across the box with a diagonal drawing stroke, as above set forth."

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17. For an *Improvement in Carriage Steps;* David and E. Z. Little, Gettysburg, Pennsylvania, October 7.

The patentees say,—"The nature of our invention consists in causing the steps to be swiveled round under the carriage when folded up, out of the way of the mud and dirt thrown from the wheels, and without turning them up inside of the carriage."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is constructing the steps and attaching them to the body of the carriage, in the manner described, so as to allow them to be twined under the body when not in use, and held in either position, as described."

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18. For *Improvements in Fire and other Engines for throwing water;* Charles W. Grannis, Persia, New York, October 7.

The patentee says,—"It is well known that in fire and other engines for throwing water, the air vessel into which the water is forced on its way to the discharge pipe, for the purpose of equalizing the discharge, by the elasticity of the air contained, is liable to a serious objection, viz:—that of mixing the air with the water, which causes the column of water to break into spray on leaving the discharge pipe, and that if the engine be kept at work for any considerable length of time, all the air is discharged from the vessel. This defect arises from the imperfect manner in which the air vessel is connected with the cylinder and discharge pipe, in such manner that all the water has to be forced through the air vessel.

"The nature of my invention, devised for obviating this difficulty, consists in placing the air vessel of a double acting engine between the two branch pipes which form the connexion between the two ends of the cylinder and the discharge pipe, and connecting the air vessel with them by means of pipes inclining upwards from the air vessel to the branch pipe, or rather inclining in the direction of the

discharging current, by means of which that violent agitation which takes place within the air vessel on the usual plan, is entirely avoided, the outward current being without the vessel, whilst the body of air within the vessel is pressed on either side by the pressure of the water. This constitutes the first part of my invention.

"It is a well known physical law, that all fluids issuing from a vessel through an aperture, take a rotary motion, and hence the difficulty of throwing a solid unbroken column of water—a result admitted to be very important. This whirling motion of the water is necessarily due to the force applied, and by that much reduces the distance to which the column would otherwise be thrown. The object of my second improvement is to avoid this whirling motion, and at the same time save the power thus consumed, and consists in providing the bore of the discharging nozzle, or pipe, with wings parallel with, and converging to, the axis of the bore, whereby the column is divided into as many parts as there are wings, and the rotation of the water prevented."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is arranging the air vessel of double-acting force pumps between the two eduction or branch pipes, when the connexion is formed by means of two pipes, inclining from the air vessel to the branch pipes in the direction of the issuing columns, as described, whereby the discharge of air from the vessel is effectually prevented, and the elastic force of the air exerts a more direct force on the column of water at the end of the stroke of the piston than by any known arrangement.

"And I also claim the employment of a wing or wings within the bore of the nozzle or discharge pipe of fire and other engines for throwing water, as herein described, by means of which the whirling motion of the stream is prevented, and a more solid column obtained than by any other known method."

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19. For *Improvements in the Furnace for the manufacture of Articles of Iron;* William H. Passmore, Wayne, Maine, October 7.

The patentee says,—"For the purpose of heating scythes and other articles of a like character, up to the proper degree for hardening, the general practice heretofore has been to take them in their cold state and to pass them over the fire in a heating-furnace, constructed for that purpose, taking care to heat them as equally as possible in every part; but as scythes, swords, and other articles, having a cutting edge, are unequal in thickness, their thinner parts are the most quickly heated, and are liable to be injured from this cause before their backs or thicker parts are sufficiently heated for hardening. To guard against this result it has been necessary to heat them slowly, which is necessarily attended with much loss of time, whilst after all the evil is but partially corrected. In my improved heating furnace, I employ a case or oven of cast iron for the purpose of heating the scythes or other articles, previously to their being passed over the fire in the ordinary heating furnace; and in this case or oven I bring them to such a de-

gree of heat as will enable me to complete the heating in the ordinary furnace with great rapidity. As the preparing oven contains a considerable number which are necessarily placed within it, they have ample time to allow their thicker and thinner parts to be brought up to the same degree of heat."

Claim.—"Having thus fully described the construction of my improved furnace for heating scythes and other articles to be hardened, what I claim therein as new, and desire to secure by letters patent, is the combination of the preparing case or oven with the heating furnace heretofore employed with said preparing oven, being formed and combined with the furnace, substantially in the manner and for the purpose set forth."

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20. For a *Machine denominated a "Rotary Curve," to be used in constructing Cisterns;* Orlando Owen, Burlington, Vermont, October 7.

The patentee says,—"The usual mode of building cisterns is to form an inner and outer curve or mould of wood (the outer one extending only to the top of the cylindrical part of the cistern) with the space between equal to the thickness of the wall, which is formed by pouring in small stones and hydraulic cement until it reaches the top of the outer curve, it is then carried for a short distance on the top of the inner curve to narrow the opening, and the whole suffered to dry, which necessarily takes much time, as the curves exclude the air and the cement dries very slowly; but when it is dry the inner curve can only be removed by breaking it to pieces. The object of my invention is to avoid this inconvenience and to save much of the time required for drying the wall, and this I effect by means of a segment curve attached to one end of an arm connected with a central standard, in such manner that it can be moved around the standard, and carried up and down and inclined to form the top—the arm being made in two parts that slide on each other, to adapt the segment curve first to enable the operator to trim the hole in the earth to the required diameter for the outside of the cistern, and then to the inner diameter thereof. The two parts of the arm slide on each other, and can be secured at any desired point by means of a set screw, and it is connected with the central standard by means of a ferule, to which it is jointed, which ferule can be held at any desired elevation by a pin passing through holes in the standard; and for the purpose of giving the arm any desired inclination, it is mortised and plays on a sector attached to the upper part of the ferule, and provided with holes and a pin."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the segment curve with the arm, ferule, and standard, for the purpose and in the manner substantially as described, and these thus combined also in combination with the sector for forming the arched top of the cistern, substantially as described."

21. For an *Improved Washing Machine;* H. B. Masser, Sunbury, Pennsylvania, October 7.

The patentee says,—"The nature of my invention consists in carrying the whole body of water in the machine up to one end, where it is allowed to percolate through the clothes, and thus wash them without pressing or rubbing them, by simply forcing the water through the clothes, by which much labor is saved and the clothes washed without wearing."

Claim.—"Having thus fully described the nature of my invention, and shown the operation thereof, what I claim therein as new, and desire to secure by letters patent, is the combination of a dasher having a valve therein, as above described, with a wash board and side pieces, so arranged as to allow the water forced up by said dasher in front to pass behind the same, substantially in the manner and for the purpose set forth."

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22. For an *Improved Engine, Operated by the Explosion of Gases;* Stuart Perry, New York, October 7.

The patentee says,—"My first improvement consists in surrounding the cylinder of the engine with water, to carry off the heat generated by the explosion of the gases, and keep it at a sufficiently low temperature for the efficient action of the engine, and at the same time in certain cases to employ this surrounding water, as a water bath, for the retort which generates the inflammable gas, when the gas is generated from a liquid or liquids, the heat generated by the combustion of the gases being sufficient to keep the water at the temperature required for generating the gas, whilst the water carries off the heat from the cylinder to prevent its being overheated. My second improvement consists in lubricating the piston and the inside of the cylinder with water, which not only prevents the wear of the parts, but at the same time aids in preventing these parts from being overheated. My third improvement consists in lubricating the piston rod, and preventing it from being overheated, by surrounding it with water, at or near the stuffing box. My fourth improvement consists in a new method of inflaming the gases, by platina heated by the heat of inflamed jets of gas and air from the retort acting thereon, the platina being so situated as to communicate by a valve or valves directly with either end of the cylinder, or with the passages through which the mixed gas and atmospheric air pass to either end of the cylinder. And my fifth improvement consists in the employment of a receiver containing condensed atmospheric air for starting the engine, in combination with another receiver, and with an air pump, by means of which atmospheric air is forced for the continued working of the engine, the said air pump being operated by the engine."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, surrounding the cylinder and induction passages of an engine, operated by the explosion of gases with water, for the purpose of keeping it at the requisite temperature as described; second, cooling and lubricating the inside of the cylinder and piston

of an engine, operated by the explosion of gases by injecting water within the cylinder, whether this be effected in the manner herein described, or in any other manner producing the same effect as described. Third, cooling and lubricating the piston rod and stuffing box of an engine, operated by the explosion of gases, by injecting water around the piston rod and within the stuffing box, substantially as described. Fourth, the method of inflaming the explosive mixture in the cylinder, or in the induction passages, by means of heated platina, or other metal having like properties, and provided with a valve or valves, by which the heated surface can be separated from the explosive mixture, substantially as described. And, fifth, the combination of a receiver of condensed air, filled by an auxiliary force, with the receiver, into which air is forced during the action of the engine, as described, for the purpose of starting the engine as described."

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23. For an *Improved Fire Grate for Heating Apartments, &c.;* John Goldenburgh, Cincinnati, Ohio, October 7.

The patentee says,—"The nature of my invention consists in causing the smoke, &c., from a fire grate constructed in the ordinary way, to descend on each side of the said grate in a line parallel with the front thereof, and thence return up and pass out of the chimney, thus heating a broad space on each side of the fire chamber or grate and economizing the fuel,—the draught in said flues being regulated by dampers placed just below the return, which when open will admit a sufficient quantity of air from the room to the flue, to check the draught through the fire in any desirable degree."

Claim.—"Having thus fully described my improvement, what I claim therein as new, and desire to secure by letters patent, is the combination of the dampers with the descending flues behind the front plate, and dampers connected with the grate, the whole being constructed and arranged substantially in the manner and for the purpose set forth."

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24. For an *Improved Coupling for Railroad Cars;* James A. Cutting, and George Butterfield, Boston, Massachusetts, October 7.

The patentees say,—"The nature of our invention consists in coupling the cars to the locomotive and tender, and to each other, in such manner, as that the elevation or depression of the locomotive above or below the line of the rails, will disconnect the locomotive and tender from the cars attached to them, and at the same time disconnect the cars from each other."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner in which we connect and disconnect a car to and from the tender of a locomotive by means of the jaws, the connecting tongue, the sliding gate, the lever and fulcrum arm, combined and operating substantially as herein set forth. We also claim the manner in which we connect the sliding gate of the coupling apparatus, between the tender and the foremost car, to the sliding gates

of the coupling apparatus between the remaining cars of the train, by means of the lever, the roller shafts, the connecting rod and lever, combined and operating substantially as herein described and represented."

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25. For an *Improved Method of Moulding for Castings;* Francis N. Still, Buffalo, New York, October 7.

The patentee says,—"The nature of my invention consists in using two patterns for one casting, and having those patterns placed with the reversed sides up, and made stationary in two separate flasks, filled with plaster of Paris; my object in using two patterns, is that I may mould from concave and convex patterns, such as cannot be divided or moulded from a plate; my object in using the two flasks of plaster of Paris, is that I may get two concave and convex surfaces to fit each other perfectly, and at the same time fit the particular shape of the patterns, so that when a flask of sand is filled upon each of them, taken off, and closed together, it will form a perfect mould from said patterns."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the second pattern or patterns by taking an impression of the first upon plaster of Paris, or other similar substance, and placing duplicate patterns in the cavities made by the patterns of the first, substantially as herein described.

"I do not claim moulding from plain patterns, such as can be divided and moulded from each half, nor from such as can be moulded in connexion with a plate."

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26. For an *Improved Cooking Stove;* William B. Treadwell, Albany, New York, October 7.

The patentee says,—"The object of my invention is to throw the heated current from the fire box *directly* upon the *rear* boilers, and before its heat has been reduced by passing around the oven."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the dividing the space between the top of the oven and the top plate of the stove into two distinct and parallel flues, by means of the horizontal partition plate, the upper flue communicating directly with the smoke pipe, and the lower connected with the fire-box by openings governed by dampers; the whole being constructed and operating as herein described and represented."

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27. For an *Improved Machine for Shelling Corn;* James Murray, Baltimore, Maryland, October 7.

The patentee says,—"The part of the machine by which the shelling is effected is similar to some others which are now in use, consisting of a shelling wheel revolving vertically, having teeth on each of its sides that operate on the ears of corn which are fed in vertically through feeding troughs constructed in the usual manner. With

this I have combined an apparatus for separating the grain, the cobs, and the dirt or chaff from each other, without the use of a fan wheel or other blowing apparatus. This has been heretofore attempted, but it has not been effectively accomplished, owing to the great force with which the grain, cobs, and chaff, are projected in all directions in the rapid operation of shelling. My improvement consists in the manner in which I combine guards of leather, or of other flexible material with the feeding trough and with the separator or screen, so as to arrest the force of the flying particles, and to prevent their insinuating themselves between the vibrating screen and the body of the machine, which if not prevented, will quickly obstruct the motion, and finally arrest it altogether."

Claim.—"Having thus fully described the nature of my improvement in the machine for shelling and cleaning corn, what I claim therein as new, and desire to secure by letters patent, is the employment, in the manner set forth, of the guards of leather or other flexible material, for the purpose of preventing the escape of the corn with the cobs, and the choking of the machine by the insinuation of chaff and dirt into the moving parts thereof."

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28. For an *Improved Machine for Shelling Corn;* Jonathan W. Gordon, Jamestown, North Carolina, October 7.

The patentee says,—"The nature of my invention consists in a revolving screw-formed sheller having a stationary holder through which the ear of corn is drawn by the screw, said holder preventing the ear from turning while being shelled by the fire."

Claim.—"Having thus fully described my improvement, I wish it to be understood that I do not claim a revolving tube armed with teeth on the inside for shelling corn, as that has before been done; but what I do claim as my invention, and desire to secure by letters patent, is the revolving spring arms, having segments of screws on their ends for drawing in the cobs through, and teeth for shelling the corn from the cob, in the manner described, and in combination therewith the jaws for holding the ear of corn to prevent its turning while being shelled, as described."

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29. For a *New and Useful Electrical Conductor;* Réné L'Angais, Paincourtville, Louisiana, October 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the glass isolators with shoulders and cylindrical recesses, in the manner and for the purpose above described, in combination with the frame and rod, constructed as above set forth."

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30. For an *Improved Lantern for the Destruction of the Bee-Moth, and other Night-flying Insects;* Samuel C. Wilt, Hartleton, Pennsylvania, October 7.

The patentee says,—"The nature of my invention consists in the

combination of a lantern provided with a surrounding open basin filled with oil or any other fluid, for the purpose to drown and destroy such night-flying insects which may be attracted by the bright shine of the light or candle."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the lamp with the surrounding funnel-shaped glass case, in combination with the open reservoir or basin filled with oil or any other fluid, and the chimney which is inserted from above, with the cone, for the use and purpose to destroy bee-moths and other night-flying insects, as set forth in the specification."

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31. For an *Improved Revolving Axletree;* Isaac Slack, Avondale, Pennsylvania, October 10.

The patentee says,—"The nature of my invention consists in reducing the friction and steadying the wheel, by dividing the revolving axletree in two equal parts, (at the centre,) and joining them in an elevated position over the straight line of the centre of the wheels, by a tapering pin of the one axle in a straight hole of the other axletree—by this arrangement the spokes of the wheel receive the pressure perpendicularly."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is in particular the revolving axles, coming together, intersecting, and elevated above the straight line of the centre of the wheels, in combination with a straight hole in one and a tapering pin in the other, for the use and purpose as described in the specification."

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32. For *Improvements in Machinery for Drawing Water from Wells, and Raising Heavy Weights;* Harvey W. Sabin, Rushville, New York, October 10; antedated September 9, 1846.

The patentee says,—"The nature of my invention consists in raising weights, and in raising and discharging water from a well, by two alternating buckets, and regulating the height to which they are raised by a double windlass, or windlass in two parts, which can be clutched together, so as to allow the weights to balance each other for any distance required. In raising water by this method it is not necessary to touch the buckets with the hand, the object being accomplished by a crank windlass cord, or any of the usual ways."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is arranging the two ropes to wind on the drums or windlasses in opposite directions, when this is combined with one of the drums made to clutch and unclutch for the purpose of regulating the length of the ropes to suit the depth to which the buckets, &c., are to descend, substantially as described."

33. For *Improvements in Stoves;* Charles H. Rogers, and Samuel H. Hancox, Troy, New York, October 10.

Claim.—"What we claim, and desire to secure by letters patent, is the damper, &c., connected with the openings or passages for a draught of air to the fire and that which leads to the air-chamber, as by one operation to close the whole, or in part the one, and in corresponding proportion to open the other, in combination with the inside bottom plate and hot-air chamber and inside top plate therewith connected, for preventing condensation of steam and for preventing explosion; all as above specified and described."

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34 For *Improvements in the manner of Constructing Locomotive Steam Engines, with Six or Eight Driving Wheels;* Ross Winans, Baltimore, Maryland, October 14.

Claim.—"Having thus fully set forth the nature of my improvement, what I claim, and desire to be secured by letters patent, is the employment of wheels with chilled cast-iron flanches in combination with an engine having six or eight driving wheels, with axles parallel to each other, and accommodating itself to curves and turnouts, by way of the devices or modes herein described for that purpose, and having the power applied to all the axles, by connecting rods and cranks."

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35. For an *Improved process for toughening the Hull or outer covering of Wheat and other Grain, preparatory to converting the grain into flour;* J. W. Howlet and F. M. Walker, Greensboro', North Carolina, October 14.

The patentees say,—"The nature of our invention consists in passing the wheat or grain through a current or jet of steam, in any convenient manner, so that each kernel of grain shall be thoroughly acted upon by the steam, which gives to the hull such strength and tenacity that it is not pulverized by the action of the stones in converting the grains into flour, and thereby specking and deteriorating its quality, but is pealed off the wheat in large flakes."

Claim.—"The utility of toughening the hulls of the grain in some way previous to grinding, and also the difficulty of effecting this desideratum uniformly, is well known to practical millers. When grain is ground in too dry a state, the hull is so tender and brittle that a portion of it is pulverized and passes through the bolt with the flour, disfiguring its appearance, and greatly reducing its merchantable value. What we claim as our invention, and desire to secure by letters patent, is the method or process of toughening the hulls of wheat and other grains, preparatory to grinding, by the application of steam, substantially in the manner and for the purpose as herein set forth."

36. For *Improvements in the Machinery for "trimming" Brushes;* Benjamin Babbitt, New York, October 14.

Claim.—"It is not intended to claim any of the parts employed for these purposes, as all are in common use in various ways; but what I do claim as new, and desire to secure by letters patent of the United States, is the application of the two-edged knife, constructed and fixed to direct and act in conjunction with the vibrating knife, and gauge guides, adapted to the form of the brush, when employed for the purpose of trimming the faces of brushes; the whole arranged, constructed, applied, and combined, substantially as herein set forth and shown."

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37. For *Improvements in Machinery for Threshing Grain;* Clinton Foster and Levi Jones, Laporte county, Indiana, October 17.

Claim.—"What we claim as our invention, and desire to secure by letters patent, in the within described machine, is the operation of the teeth in the cylinder, for the purpose of removing the straw from the drum—each row by its own gravity sliding in the grooves, project the teeth far enough to catch the straw, which, by its revolution, is brought up over the cylinder, when they return by their gravity, and the straw is thrown from the machine."

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38. For an *Improved Annunciator, or manner of communicating with the different rooms of a hotel or other building;* T. D. Jackson and A. Judson, Rochester, New York, October 17.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the drops with the tumblers, drop-levers, and slides, substantially in the manner and for the purpose herein set forth."

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39. For *Improvements in the Saw Gin, for separating cotton from the seeds, and cleaning the fibres;* Peter Von Schmidt, Washington, District of Columbia, October 17.

The patentee says,—"The ginning of cotton with the saw gin has for a long time been attended with much difficulty, from the very nature of the fibre, its condition in the pod, and the operation of the instruments employed to separate the fibres from the seeds, to which they adhere with more or less tenacity, according to the quality.—These difficulties have led to many modifications of the gin, with the view to remedy the evils, but so far little improvement has been made in that most valuable of all modern inventions. The fibres are united to and surround the seed, forming pods, which contain motes, particles of dead leaves, and other foreign matter very injurious to the gin, and particularly to the staple when passing through the gin with the fibres; and the tenacity with which the fibres adhere to the seed, and to each other, renders it very difficult to separate them without either cutting or breaking them, or otherwise injuring them by abrasion. When the fibres are not properly loosened preparatory to

their being drawn through between the ribs by the saws, they are liable to coil around the upper part of the ribs, and are there cut by the saws, and choke the operation of the machine. Again, after the fibres have been properly separated from the seeds, much difficulty has attended the removal of them from the teeth of the saws by the rotating brush, which, by the action of currents of air drawn on both sides of the gin by the rotation of the brush, force the fibres towards and clog in the middle, so that the action of the brush fails to act equally in removing them from the saws and from the bristles; and at no time does the brush comb out the fibres, and separate from them the foreign matter, which is always found with cotton in great quantities.

"The object of my improvements is to avoid these serious evils; first, by combining with the saws and ribs a rotating cleaner, consisting of one or two arbors placed parallel with each other, and provided with pins projecting therefrom radially, and playing between each other and between permanent teeth, so that by their rotation they act on the pods of cotton, loosen the fibres and separate from them motes and other impurities, which fall through the grated bottom of the hopper. From this cleaner, the cotton falls on to the saws, and is acted upon by the teeth; but if the pods are not sufficiently loosened, they are carried up and again acted upon by the cleaner, and thence again fall on to the saws. In this way the pods are not only freed from all impurities, but the fibres are sufficiently loosened to be separated from the seeds without injury to the staple or the liability of breaking the seeds, the particles of which, when carried through by the saws, are very injurious to the staple. Second, in making the upper surface of the ribs or grates between the saws without a double beveled surface, with a series of transverse projecting ridges from the bottom to the top, and also in having their lower ends attached to a hinged frame which rests on springs, the effect of which is that, as the pods are carried up from the bottom of the hopper, they strike against the projecting ridges or teeth, which causes them to roll up, at the same time giving to the ribs, in consequence of their spring attachment, a tremulous motion that greatly facilitates the action of the saw teeth on the fibres, as the pods are thus carried towards and from the teeth, which have the action of combs to loosen the fibres. Third, in providing brushes below the rotating brushes, and placed parallel with the axis thereof, and slightly inclined in the direction of the rotation, for the purpose of combing or brushing the fibres which are caught by the stationary brushes and acted upon by the rotating ones; and when properly brushed, and the motes and other impurities separated from them and discharged through a grating below, are liberated from these stationary brushes and delivered in the usual manner. And fourth, in providing the ends with spiral fans, which draw in a current of air from each end, and force it out by centrifugal action equally from end to end of the saw cylinder, to liberate the fibres from the brushes, and to generate an outward current to carry off the motes and other impurities below the stationary brushes and the concave, on to which the cleaned and brushed fibres are delivered."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the cleaner, when placed in the hopper and forward of the saw, in combination with the gin saws and ribs, substantially as described, whereby the pods of cotton are loosened and the trash cleaned out, and the unginned pods that have been acted upon by the saws, are carried back to the cleaner, again to be acted upon by the teeth thereof, as described.

"Second, making the upper and outer surface of the ribs between the saws with a series of teeth, substantially as described, for the purpose of resisting the upward movement of the pods, and causing them to turn as they are carried up, as described.

"Third, attaching the ribs so as to vibrate at the top, on a hinged joint, when this is combined with a spring connexion at bottom, substantially as described, whereby they receive a tremulous or vibratory motion to carry the pods towards and from the saws, as described.

"Fourth, the series of permanent brushes below the rotating brushes, when combined with the rotating brushes and saws, substantially as described, for brushing the fibres, and more effectually removing the motes and other impurities therefrom, as described; and in combination with this, I further claim the grate and discharge passage for the motes and other impurities, below the permanent brushes, substantially as described. And, finally, I claim, in combination with the rotating brushes, the spiral or oblique fan blowers at each end, substantially as described, for the purpose of introducing within the brushes currents of air to discharge the fibres from the brushes, and to carry out the motes and other impurities, as described."

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40. For *Improvements in the Press for pressing Hay, Cotton, &c.;* Nicholas Lampman, Coxsackie, New York, October 17.

The patentee says,—"In the press patented by W. C. Van Hoesen, on the first of February, 1842, the progressive levers are attached to, and operate the follower, are worked by cords or chains attached directly to them, the lower ends of the levers being provided with rollers that run on the bed of the machine. If it be desired to apply a double purchase to these progressive levers, a pulley must be attached to each of them, around which to pass the ropes or chains, so that in addition to the friction of the rollers that run on the floor of the press, there is the friction of the pulleys, and the additional complexity of parts. The object of my improvement is to obviate this difficulty, and attain the desired end by making use of the rollers on which the ends of the levers run, to answer the additional purpose of pulleys, by making each roller with two treads, to run on rails, each tread having an inner flanch to guide it—and making a groove between the flanches, of the same diameter as the treads for the reception of the rope or chain, to avoid the slip of the rollers on the rails. This arrangement, in addition to the advantages above enumerated, admits of making the parts stronger, and of working the levers up to a vertical line, which cannot be done with the old plan, for the space which would be occupied by the windlass and the pulleys, with

their attachment, would necessarily be greater than the space between the levers, where they are joined to the follower."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method herein described of forming the connexion between the windlass and the ends of the progressive levers by passing the chains or ropes by which they are operated, around the rollers that run on the two rails, the treads of the rollers and the pulleys around which the chains or ropes pass being of equal diameters, to prevent slipping or bighting; all substantially as herein described."

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41. For an *Improved mode of giving Feed to Saw Mills;* Nathan Compton, New Garden, Indiana, October 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the new and improved feeding hands, herein described, to saw-mills, acting laterally by a bight on the wheel, and insuring greater precision and regularity in giving feed to the saw."

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42. For *Improvements in the Steam Engine;* N. N. Barlow, Homer, New York, October 21.

The patentee says,—"In the steam engine as now constructed, the piston must be accurately fitted to the cylinder, and packed; the cylinder is then provided with a head or cover, accurately fitted and bolted, and provided with a stuffing box around the piston rod; and then the end of the piston rod, where it receives the connecting rod, is either provided with a sliding head working on ways, or with a parallel motion, which are not only very expensive, but either of these modes occupies much room; for there must be, between the upper end of the cylinder and the beam or other connexion, room sufficient for the length of piston and connecting rods, which, in many instances, is a source of great inconvenience, as, for instance, in steamboats.

"Many of these objections I avoid, and render the engine cheaper and less liable to derangement, by making the piston a long hollow cylinder, the outer diameter of which fits, either accurately or loosely, the inside of the steam cylinder, the upper end of which is provided with a stuffing box which surrounds the hollow cylindrical piston: that is, therefore, made of greater length than the steam cylinder within which it works, thus avoiding the necessity of a packed piston. The inner end of this piston cylinder is closed to form the piston head, and to the inner surface of it is attached the connecting rod, which extends to the crank. By this arrangement, the unequal wear of the piston and cylinder by the vibrations of the connecting rod is avoided. The steam, of course, in this arrangement, can act only in one direction, and therefore will be only single-acting; but when it is desired to make a double-acting engine, then two such single-acting engines are so arranged as to be connected together by a crank shaft, having two cranks on opposite sides of the axis, so that the moment

one ceases to act the other commences, the valves alternately opening and closing the induction and eduction valves.

"It will be obvious that this engine may be single-acting by having but one cylinder and its appendages; double-acting, as above described; threefold-acting, by having three cylinders with the cranks, making an angle of 120° with each other, so as to divide the circle into three equal parts, the threefold-acting being the best for working the steam expansively, by means of cut-off valves, as the steam will at all times be acting with its full force in one, and expansively in another.

"By constructing an engine on this plan, but one packing will be required for each cylinder, and that a stuffing box which admits of adjustment much more readily than a piston, which can only be repacked by taking the engine apart. It dispenses with the necessity of a sliding head or parallel motion, the cylindrical piston performing that office by having the connecting rod jointed to it within and at the bottom, at the same time saving the room occupied by the piston rod in the common engine; and what is of great importance, the piston can always be kept oiled by simply oiling the stuffing box, which is not the case in engines as heretofore made."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the pistons of steam engines cylindrical, and of sufficient length to work through a stuffing box around it, at the open end of the steam cylinder, substantially in the manner and for the purpose specified, in combination with the jointing of the connecting rod to the bottom thereof, for the purpose of saving the room occupied by the piston rod, the piston being guided by the stuffing box at the end of the cylinder, and preventing the upper edge of the piston from cutting the cylinder, as would be the case with a shorter piston, as described."

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43. For an *Improved Machine for Polishing and Finishing Cloth;* Josiah C. Carlisle, Armagh, Pennsylvania, October 21.

We are compelled to omit the claims of this patent on account of their reference to, and dependence on, the drawings.

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44. For *Improvements in the Manufacture of Cast Steel;* Josiah Marshall Heath, London, England, October 22; in England, February 4, 1846.

The patentee says,—"The process now universally in use for making cast steel is to reduce pig-iron of suitable quality into bars of malleable iron; to convert these bars into blistered steel, broken into fragments, in close crucibles; and to pour the fluid steel into iron moulds.

"The expense attending these different processes is enormous. If the cost of pig-iron of a quality suitable for good steel be £8 a ton, the cost of cast steel, in ingots, made from such pig-iron, by the usual process, will amount to upwards of £30, or four times the cost of pig-iron. I have discovered a process by which the conversion of pig

into bar iron, of bar iron into blistered steel, and the use of crucibles for melting the blistered steel, may be dispensed with, and cast steel may be manufactured at a cost far below that of the old process.

"This is done by melting together a mixture of pig-iron and malleable iron in such proportions that the fluid mass arising from the mixture shall contain just that amount of carbon which, when combined with iron, forms steel.

"The process I now use is described as follows: The pig-iron to be converted into steel may be melted in a cupola, or it may be run direct from a blast furnace used for smelting iron ore; but the most suitable apparatus I consider to be a common cupola furnace, blown with hot air, in order that the metal, when run from it, may retain its highest possible temperature. The fluid pig-iron shall be run from a cupola or other furnace into a receptacle, made of any material capable of withstanding an intense heat, similar in form to a common refinery, or to the shallow well of a reverberatory furnace for melting pig-iron, and the quantity of fluid pig-iron used for one operation should occupy about one-third, or thereabouts, of the capacity of the receptacle. The interior of this receptacle and its contents should be kept at the highest temperature that can be produced; and I find a very ready and convenient method of producing this high temperature to be by currents of ignited carbonic oxide gas, conveyed through pipes placed round the top of the receptacle, slightly inclined downwards, so as to bear upon the surface of the fluid metal. A sufficient temperature for this purpose may also be produced by a current of oxy-hydrogen gas, produced by directing a stream of atmospheric air into a current of hydrogen gas, formed from the decomposition of water allowed to trickle upon malleable iron brought to a high heat. In order to burn the carbonic oxide, it is necessary to introduce along with it a current of hot atmospheric air; or, if a more intense heat is required, a current of oxygen gas. In either case, however, care must be taken that the proportion of atmospheric air, or of oxygen gas, does not exceed that which is required to convert the carbonic oxide into carbonic acid, as any excess of oxygen in the blast would have a most injurious effect upon the melted metal in the receptacle.

"The carbonic oxide may be obtained from the waste gas from the cupola employed to melt the pig-iron, or from a blast furnace, or it may be generated in a separate apparatus by the imperfect combustion of any fuel; and the application of it may be in any of the numerous and well known methods already in use. The proportion of hot atmospheric air, or of oxygen gas necessary to form carbonic acid, may be exactly regulated by means of stop cocks or valves in the pipes by which the hot air or oxygen gas is conveyed into the streams of carbonic oxide.

"In order to decarburate the fluid pig-iron in the receptacle to the degree necessary to form steel, I mix with it a certain portion of malleable iron, more or less, as I wish to make steel softer or harder; but for cast steel of a medium degree of hardness, such as is used for general purposes, I find that about equal proportions of pig and malleable

iron answer best. The proportions in which the pig and malleable iron should be mixed, however, will much depend upon the quality of the former. If gray pig-iron is used, it will require more malleable iron to be mixed with it than if white pig-iron is used. This is a point, the exact determination of which can only be arrived at by testing the quality of the mixed fluid metal in the receptacle at intervals.

"The malleable iron to be mixed with the fluid pig-iron in the receptacle may be in scraps, or in any convenient form; but by far the most economical, convenient, and purest state in which the malleable iron can be used is in the granular form, produced by reducing any perfectly pure oxide of iron to small fragments, and then submitting them to the well known process of cementation in a common converting furnace, such as is used for converting bar iron into blistered steel. The iron ore in small fragments is mixed with just that proportion of carbonaceous matter which is sufficient to combine with its oxygen at a red heat in a close vessel; and when the process is finished, the malleable iron is obtained in the purest possible state.

"Before adding the malleable iron to the fluid pig-iron, the former must be brought to a white heat, and this may be done in a separate furnace; but I find the most convenient method is to place the malleable iron on a bed between the receptacle which holds the fluid pig-iron and the chimney up which the waste heat from the combustion of the gas passes. The malleable iron, when at a white heat, is raked into the receptacle containing the fluid pig-iron and the whole is kept in fusion and stirred about for a sufficient time to produce intimate mixture and uniformity of composition into the fluid mass; and when the assays taken from it show that the steel is of the desired quality, the contents of the receptacle are run off into moulds of any form or size required."

Claim.—"What I claim is the exclusive right of preparing cast steel by decarburating pig-iron to the degree required to form steel, by mixing with the pig-iron, run from a cupola or other furnace into a separate receptacle, malleable iron in the proportion necessary to form steel, and running the mixture of pig-iron and malleable iron, while still fluid and in the state of cast steel, into moulds from the receptacle."

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45. For *Improvements in the Mode of Constructing Pumps;* David Hinman, Brunswick, Ohio, October 24.

The patentee says,—"The nature of my invention consists in the manner in which I have constructed and connected the different castings of the double cylinder lifting and force pump, by which the parts are more conveniently and readily connected or disconnected, for repair."

Claim.—"Having thus fully described my improvements, what I claim therein as new, and desire to secure by letters patent, is connecting all the joints of a double cylinder force pump, substantially in the manner described, so as to hold them firmly together by means of one key, as above specified."

46. For an *Improved Compound Filter and Stop Cock;* William Read, New York, October 24.

The patentee says,—"My improvement consists in employing a case perforated at each end and containing sand or other filtering material which is received in an enlargement made in the stop cock between the valve and the delivery spout, which are made separate and screw on to each other at the enlargement, so that by unscrewing the delivery spout, the filter can be removed and taken out or reversed, and the spout screwed on again with or without the filter—that face of the enlargement which is connected with the delivery pipe being provided with leather or other packing, so that when the case of the filter is forced against this packing by the pressure of the column of water, it shall form a perfectly water-tight joint. And my invention also consists in making the case that contains the filtering material with a hole in its periphery provided with a screw-plug, through which the filtering material is introduced, or removed when it is required to be changed, when this is combined with a stop-cock, provided with an enlargement, such as above described, for receiving and removing the filterer."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing a filter in an enlargement or chamber of the stop-cock between the valve and delivery spout, when these are connected by screwing on each other, and provided with packing, so that the pressure of the column of water shall press the filter against it, and thus form a water-tight joint, all substantially as described, whereby the filterer can be removed or reversed for cleansing, and the stop can be used independent of the filter, as described."

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47. For an *Improved "Pessary," for a "Prolapsus Uteri;"* Joel B. Merriman, Sheffield, Massachusetts, October 24.

The patentee says,—"The nature of my invention consists in making a pessary of glass or any other hard substance that might be used for like purposes, but I give a decided preference to glass, as it is much smoother and less liable to corrode than metals. It consists of a hollow cylinder or pipe about five inches long, a little curved to correspond to the natural passage to the uterus, the principal part of the curve being nearest to the upper part of the pipe, the upper end of said pipe is concavo-convex, and about two inches in diameter, the convex part being attached to said pipe, the concave surface being for the support of the uterus; the lower end of said pipe has a plano-convex basis about one inch in diameter, the convex part being attached to said pipe."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the attaching to the pessaries a curved inflexible tube, as set forth in the specification."

48. For an *Improved Boiler for the Heating of Tanning Liquids and other Fluids;* Warren Nims, Port Ann, New York, October 24.

The patentee says,—"In the process of tanning as now carried on, the tanning liquid, which has been allowed to act on the skins, until it is nearly spent, is reheated and made to act upon fresh bark, so as again to become saturated with tannin. My boiler has been constructed with a view to its application to the heating of such exhausted tanning liquids, but is equally applicable to the heating of liquids for a variety of other purposes. I construct a boiler of sheet metal in the usual way, and above this I place a reservoir or cistern, into which the liquid to be heated may be raised from a tan vat or other receptacle by means of a pump. From the bottom of this cistern a pipe descends and passes through the top of the boiler which is to be kept entirely full of the liquid. Below the boiler is a furnace or fire chamber in which wood is to be used as fuel: this fire chamber I divide into two compartments, the number may however be increased, but I deem two sufficient for all useful purposes. This division into compartments consists merely in a double tier of tubular grate bars to support the fuel. In the boiler that I have essayed, these tubular bars are about three inches in diameter; three, or any other preferred number of these are used in each compartment crossing the fire chamber from side to side. They are closed at their ends, and the liquid from the boiler is admitted into them through smaller tubes, say of one inch in diameter, which tubes may enter those which constitute the grate bars near their ends at each side of the fire chamber. The liquid which thus enters is not to be returned to the boiler, but is to be conveyed from the larger transverse tubes first named, into a tube which rises vertically at the rear end of the boiler to a height equal, or nearly so, to that of the top of the boiler, where it is furnished with a cock, by means of which the heated liquid is allowed to run off and be conveyed into a vat or receptacle, where it may be wanted."

Claim.—"Having thus fully described the manner in which I construct and manage the respective parts of my boiler and furnace for the heating of tannin or other liquids, and shown the operation of the same, what I claim therein as new, and desire to secure by letters patent, is the manner of combining the boiler (which is to be kept full of liquid) with the respective series of hollow grate bars, and with the delivery or discharging tube, by means of the series of smaller tubes, arranged and operating substantially as herein made known. I do not, of course, claim the use of grate bars, made hollow for the purpose of passing water or other liquid through them, this having been frequently done; but I limit my claim to the special arrangement and combination of the respective parts of my apparatus, by which it is adapted to the attainment of the end therein proposed."

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49. For *Improvements in the construction of Carriages for Railways;* William Coles Fuller, London, England, October 24.

The patentee says,—"My improvements consist, firstly, in placing a cushion at each end of a railroad carriage, and covering the whole

or the greater part of each end of it, in such a manner that in case of a collision of a train, the cushions of the carriages may diminish the effect of the concussion, and tend to the security of the passengers. The second part of my improvements consists in the application of buffer springs of vulcanized India rubber or caoutchouc; and the third, in the forming of the springs that support the body of India rubber, in manner hereinafter described, for the purpose of promoting the ease and safety of the passengers, and the safety of the transit of goods."

Claim.—"Having thus described my invention, and the manner of carrying the same into effect, I would observe that ordinary India rubber is liable to be affected by changes of temperature, and to become hard or rigid by exposure to cold, and therefore I prefer to use India rubber or caoutchouc prepared with sulphur, in the manner described in the specification of a patent granted in the United States to Charles Goodyear, as caoutchouc thus prepared is not liable to be acted upon by any ordinary temperature to which it may be exposed. And I hereby declare that I claim as my invention—

"*Firstly*—The application of cushions to the ends of railway carriages, as represented, and hereinbefore described.

"*Secondly*—I claim the manner set forth of forming the buffers of disks of India rubber, with plates of metal interposed between them, as herein shown and described; that is to say, the metallic disk being made larger in diameter than those of the India rubber, for the purpose set forth.

"*Thirdly*—I claim the manner set forth of forming the carriage springs of long straps of India rubber, extending along between teeth, and substantially as described and represented."

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50. For an *Improved Swingle-tree for Carriages;* H. C. Wiatt, Weldon, North Carolina, October 29.

Claim.—"What I claim as new, and desire to secure by letters patent, consists in the combination of the swingle-tree, springs, catch, and key, arranged and operated substantially in the manner herein described."

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51. For an *Improved Apparatus for cutting Screws on the rails of Bedsteads, and tapping posts to connect therewith;* Joseph Guild, Cincinnati, Ohio, October 29.

Claim.—"Having thus fully described my improvements, what I claim as my invention, and desire to secure by letters patent, is the combination of a series of augers, in the manner described, by means of the connecting rod and bars, substantially as described, and connected with an apparatus for cutting screws on bedsteads, as herein set forth, and for the purpose specified, so that any required number of holes can be bored, and in the right position for the pins. Lastly, I claim attaching a cutter to the top for cutting the first turn of the thread from the nut, so as to allow the rail to enter the post up to the

shoulder, as above specified; the whole being performed at one operation."

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52. For an *Improved Cooking Range;* Moses Pond, Boston, Massachusetts, October 29.

The patentee says,—"As the cooking ranges have heretofore been made, it is impracticable to have more than two boilers or boiling chambers, one on each side of the fire chamber, two lateral flues being arranged to pass around the boilers and communicate with the oven behind and above; and as it is very desirable to increase the capacity of a range by the addition of other boilers, I have made an improvement by which I effectually attain this important end; which improvement consists in the addition of two boiler chambers, one back of each of the side boiler chambers heretofore employed, and so separated from them by partitions and dampers, as to use only one, or both, on each side, at pleasure."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the additional boiling chambers with the front boilers, and elevated oven of cooking ranges, substantially as herein described, whereby I am enabled to increase the capacity of cooking ranges as described; and I also claim in combination therewith the additional side flues and dampers, by which the products of combustion can be made to circulate around the front boilers before passing to the additional boilers, substantially as herein described; thus affording the ready means of regulating the heat of the front boilers, as herein described."

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53. For an *Improved "Tailors' Measure;"* Benjamin G. Martin, Richmond, Virginia, October 29.

Claim.—"What I claim is the invention of a brass plate, graduated with slides, clamps, and graduated straps, that will enable me, by the aid of a tape, to take measures for garments, and determine the commanding points, with more accuracy than any with which I am acquainted; the plate and straps being applied as set forth in the specification."

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54. For an *Improvement in the construction of the Piano Forte;* John Schriber, New York, October 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction and arrangement of the cast iron ribbed plate A, having an adjustable screw for extending it, in combination with the bar B and set screw F, for giving the proper tension to the strings, made and arranged in the manner set forth.

"I also claim attaching the strings to the tuning pins below a concave rest plank, constructed and arranged in the manner set forth, in order to the effect above described.

"I also claim the manner of tuning the piano, by drawing the

strings out of a straight line and into the cavity in the under side of the rest plank, as described. Also the combination of the key N, level O, and damper lever P^4, as described. I likewise claim making the sounding board in waving or serpentine lines, in the manner and for the purpose set forth."

SPECIFICATION OF AN AMERICAN PATENT.

Specification of a patent for a new method of treating Iron in the process of rolling or drawing, specially intended for Railroad bars and Locomotive tires, invented by HORATIO AMES, *of Falls-village, Ct., granted on the 29th day of July*, 1847.

We are induced to publish the entire specification and drawings of this invention, not only on account of the value and merit which it presents to our judgment, but because of the deep interest which must be felt in all such improvements by those who are engaged in the manufacture of iron, and in railroads. The great rivalship now going on in this country and in England, in the manufacture of iron, renders every improvement which looks either to the reduction of the cost of manufacture, or to the amelioration of the quality of the iron, of the highest importance. And as the cost of repairs on railroads arises in a great measure from the wear of railroad bars and locomotive tires, by exfoliation and splitting, any invention which promises to avoid this evil must be looked upon with interest. The invention in question has already excited a deep interest in England, where the inventor has secured it by patent. K.

To all to whom these presents shall come:—Be it known, that I, Horatio Ames, of Falls-village, town of Salisbury, in the county of Litchfield, and State of Connecticut, have invented a new and useful improvement in the process of working iron, and in the machinery therefor, and that the following is a full, clear, and exact description of the principles or character which distinguish it from all other things before known, and of the manner of making, constructing, and using the same, reference being had to the accompanying drawings, (Plate I.) making part of this specification, in which figure 1 is a plan of the machine; figure 2, a side elevation; figure 3, a longitudinal vertical section, taken at the line (X. X.) of figure 1; and figure 5, a like section, taken at the line (Z. Z.) of the same figure. The same letters indicate like parts in all the figures.

In the manufacture of iron, either by rolling or hammering, the fibres are all drawn longitudinally, which, for the rails of railroads, for the tires of railroad wheels, and for a variety of other purposes, renders it liable to break off in thin leaves or scales, or to split lengthwise—this state of things being very common in the two instances specified. The object of my invention is so to treat the iron, either in the original manufacture thereof, or afterwards, as to avoid this defect, and thereby render the iron for these purposes more durable,

by laying the fibres in such form and direction, as to prevent it from scaling off or splitting. And my invention consists in twisting the iron in, or before, or after, the operation of rolling or hammering, so that the fibres shall wind around one another, in a manner somewhat similar to the fibres of hemp in a twisted rope or strand.

And the second part of my invention relates to the machinery by which I carry into effect my improved process, and consists in combining two or more sets of rollers, one or both of which are to be draw rollers, and one set turning in the usual permanent bearings, and the other set or sets working in a frame or chuck that rotates on an axis at right angles to the axis of the rollers, to twist the bar of iron between the two sets of rollers.

To enable any one skilled in the art to apply my improved process of treating iron, and to construct and use the machine which I have invented therefor, I will describe the mode of procedure which I have essayed, as well as the manner of constructing and raising the machine therefor. The bloom of iron, or a bar previously formed, is taken while in a heated state, and twisted while undergoing the operation of hammering, which may be done by securing one end of the bloom or bar in a clamp and rotating it while the hammer rests on the other end; or by securing the two ends in separate clamps and twisting one of them, or both, in opposite directions, until the required twist has been given, and then subjecting it to the operation of hammering. But when the bar is to be drawn by rolling, the bar is to undergo the operation of twisting while passing between the rollers, or after it has passed between one set, and before it passes between the second set; and when it is twisted on its way to the rollers, one end of the bar may be secured to a clamp, which is to be rotated as the bar passes between the draw rollers.

As the bars thus prepared are, in most instances, to be re-worked to receive the required form or forms, according to the purposes which they are to be applied to, it will be evident that they may be twisted as they pass from the hammer or the rollers, instead of giving the twist before the hammering or rolling; and to effect this, the end of the bar may be clamped as it leaves the hammer or rollers, and the required twist given; but it is better to give the twist before the iron has undergone the operation of rolling or hammering, as it is then more highly heated, and the fibres will not be so severely strained as they would be after the metal has been partly cooled.

When iron has been treated and worked according to this process, the fibres, instead of running in the bar longitudinally, in straight lines, will run in the direction of a helix, gradually approaching to a straight line from the circumference to the axis of the bar, so that when used for making tires, or for other analogous purposes, the bar will be prevented from splitting along its length by the tenacity of the fibres, which cross the bar in the direction of a helix, instead of the mere adhesion of the fibres together: and when used for the rails of railroads, or similar purpose, none of the fibres can be separated from the mass longitudinally, as heretofore, nor can the iron be stripped off in scales until they have been cut off on each side, for, by their direc-

tion, they pass diagonally from one side, over the surface, and down the other side, whereby they are completely tied together.

Of the Machinery for working Iron in accordance with the foregoing process.

In the accompanying drawings, *a* represents a frame properly adapted to the purpose, and *b b*, two grooved rollers, such as are used in rolling mills for rolling bars of iron—the groove in each being semi-circular, or nearly so, that the two together may form a cylindrical bar. These two rollers are placed one above the other, with their journals in appropriate boxes in the two standards, *c*, *c* The shaft of the lower roller extends out beyond one of the standards, and is provided with a level cog-wheel, *d*, which mashes into a level pinion, *e*, on the main driving shaft, *f*, which turns the lower roller, to feed in the bar of iron, *g*—the upper roller being carried by the motion of the lower one. Just back of the first set of rollers above described, there is another pair, *n*, *n*, similar to the first, except that the grooves in them are smaller, to draw the iron slightly, after passing the first set—they are mounted in a hollow chuck or frame, *i*, on the forward end of a hollow shaft or mandrel, *j*, that has its bearings in two standards, *k*. *k*, and which is provided with a cogged pinion, *l*, the teeth of which engage with a cog-wheel, *m*, on the main shaft, by which the second set of rollers are made to rotate at right angles to their axes, and on an imaginary line passing through the bight of the two sets of rollers, and in the centre of the two holes formed by the grooves on the rollers at the bight of each set, the axis of the hollow shaft or mandril being in this imaginary line. Back of the clutch, and attached to the front face of the forward standard, *k*, there is a wheel, *n*, the cogs of which mash into the cogs of two pinions, *o*, *o*, on two short arbors, *p*, *p*, one on each of two opposite sides of the chuck, the other end of these short arbors being provided each with a short screw, *q*, the threads of which engage with the cogs of two pinions, *r*, *r*, one on the end of each of the rollers of the second set, so that the cog-wheel, *n*, being permanently attached to the standard when the hollow shaft with its chuck, and the second set of rollers, is turned, the two cogged pinions, *o*, *o*, travel about this wheel, which turns the arbors to which they are attached, in the direction of the reverse of the rotation of the chuck, and the threads of the screw in turn engaging with the cogs of the pinions on the shafts of the second set of rollers causes these to rotate on their axes, and in the same direction with the first set, and with a velocity relatively to the rotation of the first set, proportioned to the amount of drawing action which they are intended to exert on the bar that is to pass between.

In this way it will be obvious that, when the machine is put in motion, and a bar of iron fed in, it will pass between the first pair of rollers and be partly drawn, and then pass between the second pair, which having two motions, one on their axis, and another at right angles thereto, and on the axis of the bar of iron, it (the bar) will in consequence be twisted between the two pairs of rollers, and also drawn by them, and the fibres compressed.

From the foregoing it will be obvious that the extent of drawing action of either or both sets of drawing rollers, can be regulated at pleasure, by simply varying the size of the grooves and relative motions of the draw rollers on their axes, and their rotation on the axis of the bar of iron.

It will be equally obvious, that the number of draw rollers can be increased, without changing the principle of my invention. It is to be understood that the iron, when subjected to the compound action of drawing and twisting, is to be in a heated state, such as is practised by, and known to, iron-masters in the manufacture of iron.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the method herein described of treating iron to increase its toughness or durability for certain purposes—such as rail-road bars and tires, &c.—by subjecting it, in a highly heated state, to the compound operation of drawing and twisting, substantially as herein described.

"I also claim in the machinery above described, giving to one set of rollers the rotary motion on their axes, and a rotary motion at right angles thereto, on the axis of the bar of iron, when this is combined with another pair of rollers that have simply a rotary motion on their axes, substantially as described, whereby the bar of iron, in a highly heated state, is drawn and twisted, as described."

BIBLIOGRAPHICAL NOTICE.

"*Chemistry applied to the Manufacture of Soap and Candles, by* Campbell Morfit; Philadelphia, Carey & Hart, 1847."

The rapid progress of chemical manufactures marks a new era in the history of the arts, due partly to the development of chemical science, and partly to the spirit of thorough investigation, which is unquestionably one of the most striking characteristics of the present period of the world's history. It is but about a century since chemistry as a science can date its birth, although the germ of its existence has been elaborating during a period of several thousand years. But during that century, such an astonishing impetus has it received, that it is now engaged in unfolding, or endeavoring to unfold, the most secret and invisible operations of nature, in the production and growth of living beings; in attempting what would have formerly been regarded as irreverent, to fathom the depths of vitality; nay, to trace it to its very source, if we may credit the fond dreams of some chemical philosophers. Since the history of the chemical arts keeps side by side with that of the science, although a little more tardy than the latter, it is a fair inference that their growth is due to the science; and in fact their history shows it to be so.

But while we take a pleasure in surveying the astonishing improvements which the useful arts are daily receiving, and thus increasing and spreading the comforts of mankind at large, we hail with greater pleasure the evidences of their constant and probable never-ending

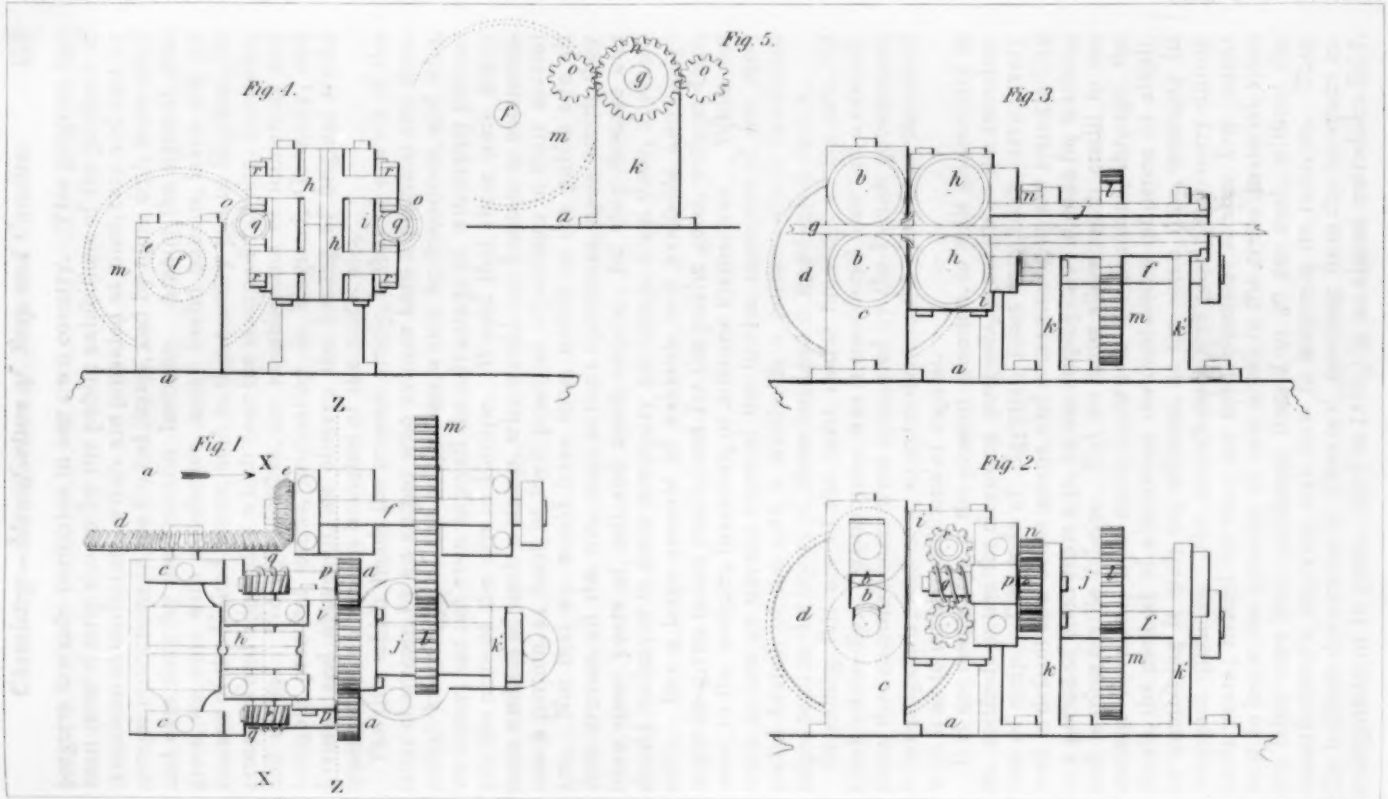
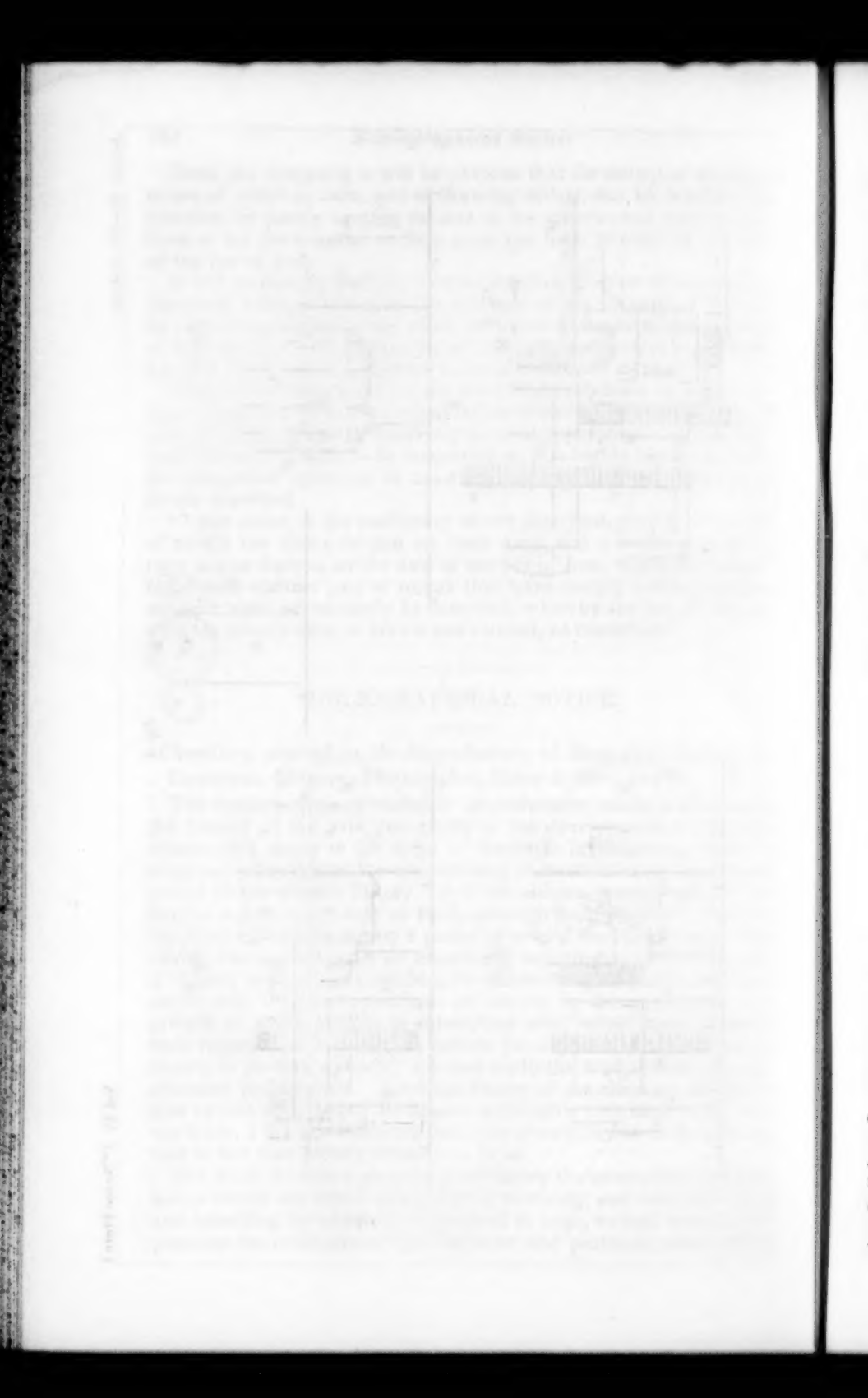


Fig. 5.
Fig. 4.
Fig. 3.
Fig. 1
Fig. 2.
X
Z



progress towards perfection in our own country. This progress has been most clearly shown by the public exhibitions of the products of American manufacture, which are provided at much care and cost by several institutions in the United States, and by none with more spirit and care than by the Franklin Institute. Among the signs of progress, we note with satisfaction many useful patents, taken out by citizens of the United States, both in this country and in England, for processes and apparatus which bear the stamp of novelty, ingenuity, and utility. We note, further, the republication of numerous and valuable practical works, originating in England, Germany, and France; and above all, we observe the issuing of original works amongst us, on various branches of the useful arts.

The title which heads the present article, is that of a work of the latter character, by an author who evinces both a practical and theoretical knowledge of the subject on which he discourses, and who, we know, has not even enjoyed the advantage of witnessing personally the state of the arts in Europe. Would that there were many more authors of such a stamp, who would not hesitate to communicate a portion, at least, of their practical experience in their several arts. Not that we would have them unfold to the public eye all their *arcana*, all the nice steps in their operations, upon which they have spent years of toil and much capital; for they deserve and should endeavor to draw pecuniary advantage from these, if practicable. But a large amount of valuable and available knowledge might be given to the public, and for the public good, without detriment to the authors, inventors, or artizans themselves. While the work before us unveils some of the hidden mysteries of one most useful branch of the arts, it withholds a portion, whose revelation might tend to the injury of those engaged in its practical details.

In calling this one of the most useful branches of the arts, we speak advisedly. So important was it considered near half a century since, that commissioners were appointed by the French government to investigate it; and now, so extensive are the operations connected with it as to involve millions of capital.

It is not necessary, on the present occasion, to refer particularly to the methods in use for cleansing purposes, previous to the introduction of soap. The soda of Egyptian lakes may have served very well in default of a better means, and some among us are retrograding to a period of 3000 years ago, by the employment of soda for washing and tearing textile fabrics. But we must allow much credit to the ancient Germans, who made known to the Romans, through the Gauls, the method of alleviating the destructive influence of alkali, by combining it with fat, without, at the same time, lessening its detergent qualities. The manufacture was nearly stationary during 1800 years; indeed we may say until chemical science first taught how to know the quantity of real alkali in the crude material, since the latter may have contained from 3 to 30 per cent., without the manufacturer's knowing well how to ascertain its richness. Then the brilliant discoveries of Chevreul, resulting from the laborious investigations of 10 years, (1813 to 1823,) in an almost untrodden field,

gave the first clear insight into the *modus operandi* of the soap manufacture, as indeed they must be regarded as having laid the foundation and partly reared the superstructure of modern organic chemistry. The grand key to the progress of the chemical arts, was the improved method of making sulphuric acid, and in 1823 the cheapness of this acid originated the manufacture of soda from common salt. By action and reaction, both oil of vitriol and soda became cheaper from more extended use, and a few years ago 60,000 tons of soda ash were annually made in England, one-third of which, 20,000 tons, were employed in the manufacture of soap.

Not less remarkable has been the progress of the manufacture of materials for illumination, which has induced the like improvement in lamps and other apparatus for illumination. We are no longer content with the smoky blaze of a pine-knot, nor with the elegant form, but irregular and smoky flame, of an Etruscan lamp. We now strive to make the night rival the day in brilliancy, and that too, without any anxiety about showers of soot from a smoky flame. Chevreul's splendid discoveries of the composition of the fatty bodies, and of the properties of their constituents, almost immediately gave rise to the manufacture of stearic acid candles, which are now scarcely inferior to the choicest wax or spermaceti. The enormous production of lard in the United States, has induced an improvement in the manufacture of stearine, (the more solid portion of fat,) in which our author claims having taken a prominent part; nor are we disposed to deny his claim, having witnessed some of the progressive steps of his improvements.

In the book before us, we admire the typography, and the neatness as well as accuracy of the wood-cuts, of which the number, 170, shows that neither pains nor cost has been spared to render it most useful to the artizan. A pictorial representation of apparatus speaks more intelligibly to the understanding than the most labored and voluminous description; and works of this kind demand a liberal combination of both. The style of writing is less commendable, betraying too little attention to this portion of an otherwise highly praiseworthy undertaking. It is not a sufficient extenuation of this neglect to say that it was written mainly for the artizan, for the latter can enjoy a good style, and if not, to put such in his hands tends to elevate his character.

Chap. xxxvi is devoted to Hydrometers and Thermometers, including a scale of Beaumè, compared with specific gravity, and a table of the centigrade and Reaumur thermometers, in degrees, compared with Fahrenheit's scale. Chap. xxxvii contains scales of weights and measures, the French and English being compared together. We cannot but think it advisable in all English works, excepting in a few particular cases, that all weights and measures should be given according to English or American standards, however defective the system may be; but this should be more especially the case in practical works, where many readers would lose much valuable information, from inability to make the requisite calculations for converting the number of one system into those of an-

other. A glossary of scientific and technical terms, in the concluding part of the work, will be found both convenient and useful.

The work contains 544 pages, devoted to two subjects—the manufacture of soap and of candles, and embraces all the most important parts of these two allied arts, entering frequently into the minutest details of the processes. It commences very properly with so much of purely chemical theories and facts, as will enable the manufacturer to understand those processes, which too often depend on mere empirical rules. A few general principles of chemical affinity introduce the subject of the alkalies and acids employed in these arts. The vegetable fats are followed by volatile oils, wax, resins, and the animal fats and oils; and among these subjects are many processes for extraction, purification, and bleaching, which the manufacturer may find it to his interest to consult. The ultimate and proximate constituents of soap, and the theory of saponification, introduce the reader into the details of the manufacture itself—the whole embracing 150 pages. We find here detailed the composition and mode of making nearly 100 varieties of soap, from the most common rosin soap, to the most delicately flavored toilet soap.

We are certainly pleased with the manner in which the author proceeds, step by step, from the foundations of the art in chemical science, to the important practical processes; so that the manufacturer may give a reason for the numberless details which he pursues, and may be enabled on sure grounds to advance his art and improve his practice. If we should object to the arrangement, it would be to that which allows the essential oils, wax, and resins, to intervene the vegetable and animal fats; while these are so closely related on chemical grounds, that we cannot well separate them. But it must be observed that the mode of obtaining the vegetable fats, by expression, and in other ways, differs materially from that of preparing the animal fats; and that this part of the work is devoted to the methods of extraction and purification. To the vegetable fats are allied the vegetable essential oils, in reference to origin and partly to the mode of preparation; and the resins cannot well be separated from the latter. On the whole, therefore, the author's arrangement is the best. He has treated with some degree of fulness, the chemical properties of the fat acids and their compounds, and we commend this subject to the careful study of the manufacturer, believing that he will be amply repaid, both by improvement in his products, and by a remunerating return. If we have a wish on this subject, however, it is that the author had been still more full of detail on all the chemistry of saponification, for we are firmly persuaded that the most numerous and valuable improvements in this and other chemical arts, must arise from the inexhaustible spring of chemical science. It is true that some blame for this defect is due to the meagreness of our works on elementary chemistry; and we hope that the author may yet find opportunity to pursue theoretical investigations in a field where he seems to be at home.

Although we regret some trifling remarks by the author, on the tricks of trade and follies of fashion, in the chapter on "Toilet Soaps,"

yet we must also regret the existence of that sickly, insatiate taste of the public, that demands the constant invention of new names for the same thing. It is undoubtedly advisable to give a toilet soap the name of the perfume with which it is scented, but to call it the "Savon aux pensez-á-moi," or "Savon à l'étoile d'amour," merely to give it currency, is ridiculous in the extreme, and a slander upon the good sense of the public. A well made rose-soap, or almond-soap, will always meet with an equally good sale under its simple English name, as under a Gallic puff or English nonsense. A tasteful label and envelope may win the eye once or twice, but the use of the enclosure will soon tear off the flimsy veil, and expose the real quality of the article. We believe it to be to the manufacturer's own interest to make the label and envelope correspond in taste and cost with the material enclosed.

The second part of the book treats of the manufacture of candles, with a short introductory on the nature of an illuminating flame. The author has likewise here progressed from the consideration of the raw material, to the manufacture of the candle itself, without despising the humble *dip*, and has devoted a chapter to each kind, the stearic acid, stearin, sperm, wax, and fancy sorts. This portion of the work is much more fully illustrated than the former, by 139 wood cuts, many of them representing entirely new apparatus or arrangements. If we were to value any one part of the work more highly than another, it would be this second part, especially chapters xlvii, xlviii, and xlix, which contain a large amount of the author's own experience in the manufacture. We especially commend chap. xlviii, "on stearin," to the public attention, as conveying his important improvement in the preparation of a pure and hard stearin, well adapted to southern climates. Lard has become one of the most important products of the United States, being rendered in quantities greater than the demand for home consumption; and since it must be exported, it is useful to inquire what is its best form for the market. Potash cannot be obtained in very large quantities, and at low prices, especially in those sections of the country where lard is most abundantly produced, nor is it likely that soda will be manufactured largely for some years to come; so that soap is not likely to be the best form at present for exporting lard, or at least it cannot be sent forth in this state alone. It would be far better to convert a portion of it into stearin and stearic acid, and to export candles. When the manufacture of sulphuric acid shall be conducted on a more extensive scale in the West, then soda, soap, and stearic acid can be produced in sufficient quantities and at such prices as to command a large home and foreign market.

We cannot applaud the introduction of many French terms by the author, although some are rendered necessary, from the want of precise English terms corresponding to the former. We can by no means allow that *Savonnier* is preferable to *Soap-boiler;* for the latter being compounded of two words, the meaning of each of which is well known to English ears, conveys to us the nature of the art, and the business of the artizan, with far greater clearness and force than any

foreign word can do, especially where, as in the present case, the foreign word gives no definite idea of the nature of the manufacture. Nor it is a sufficient apology to say that savonnier is used because the term soap-boiler rather derogates from the standing of the individual before the community. We must deny this as a fact, however the term may be construed by a part of the public. If the art be useful—if it demand skill in its execution—if it embrace chemical or mechanical science in its process—no one has a shadow of right to regard the art and its operatives other than as worthy of an honorable position in society. Even if the public should be over-nice with reference to any art, such books as that before us, will tend more than anything else to raise such art to its proper grade. Chap. ii contains some really good remarks that bear upon this point, and we will close by quoting a few passages:

"There is no pleasure so great among those which pertain to the rewards of success as that which comes from the toil of the hands well and honestly engaged; there is none more satisfactory to the mind, than that which unites the knowledge of what to do with the act of well doing; and when these qualities are associated, and are supported by perseverance, they are the sure basis of present respectability and future independence.

"Labor, properly directed by education, must secure reputation to the individual and benefit to the community. It is not in the learned professions that either fame or fortune is always found; neither is it political success that yields either greatness or content.

"If trade is followed merely for the sake of its moderate gains, it will always keep its votaries in a dull road of antiquated forms and habitual error; but if men are taught in their earlier days, that education is the best preparative for the work-shop, they will bring with them into their future laboratories the powers of other influences than those of mere ingenuity; they will come with new levers, those of the cultivated intellect; and with the inspirations of a laudable ambition and a forecast of the future, will strike out inventions and improvements to elevate their names and benefit mankind.

"The theory which accounts for the union of oils and alkalies in the formation of soaps, or the decomposition of fats into their crystaline acids, is as abstruse as that which expounds some of the most refined instances of affinities. The manufacture of soaps and candles is, therefore, strictly scientific, and they who desire to advance in that art, must not merely make, but make understandingly; so that each result may be an advancing lesson for their own profit, while it enables them to repay the benefits they have derived from chemistry, by furnishing, from their experience, new lights to their fellow men."

MECHANICS, PHYSICS, AND CHEMISTRY.

Report on an Apparatus for Supplying the Boilers of Marine Steam Engines with a Continuous Supply of Fresh Water. Invented by CAPTAIN JOHN ERICSSON.

Through the courtesy of the Author, C. H. Haswell, Esq., we are enabled to submit to our readers the following interesting report upon some improvements in Marine Engines, invented by Capt. Ericsson, and adapted by him to the United States Revenue Steamer "Legaré."

Capt. Ericsson has since applied his apparatus in the United States Steamer Massachusetts, having made some modifications, which were suggested by the experience in the "Legaré," and we learn that its performance is now perfectly satisfactory. COM. PUB.

New York, October 31st, 1847.

SIR.—In acceptance of your invitation of the 17th ultimo, we, the undersigned, had the honor to meet together in the city of New York, with the view of testing and reporting upon an apparatus invented by Captain John Ericsson, for the purpose of supplying the boilers of marine steam engines with a continuous supply of fresh water, and applied by him under your direction in the United States Revenue Steamer Legaré.

We have now respectfully to report, that on the 23rd ultimo we embarked in the Legaré at 12 M., proceeded to sea, and remained on board till the following morning. During this time the boiler was in operation 15 hours, and we had ample opportunity of examining the means employed for supplying it with water and the results produced.

By the ordinary method of condensing steam in marine navigation, boilers are supplied with the *water of condensation*, composed of the steam that is withdrawn from the boiler and the necessary quantity of salt water required for its condensation. Hence, a boiler in operation is constantly parting with steam (fresh water) and receiving salt water in exchange. The effect of this operation, uninfluenced by a correction, would be, that in a few hours a degree of saturation of the water in the boiler would be reached, that would precipitate upon the plates of the furnaces and flues, a scale of sufficient thickness to arrest the passage of the heat to the surrounding water and cause the destruction of the plates, by exposing them to a temperature destructive of their tenacity. The correction in use is the removal of the water as it approaches saturation, and is effected by *blowing*, or *pumping off*.

In the operation of either of these methods, it is apparent that there is a loss of the heat that has been imparted to the water blown or pumped off, that neglect to open or shut the blow-off cock, or in the admission of the required supply of water, involves the duration of the boiler and may, as it frequently does, involve the lives of the passengers and the crew, and the safety of the vessel. Even when all practicable attention is given to blowing-off, salt scale will be deposited in long voyages, particularly in the middle latitudes, and accumu-

late to an extent that renders its removal imperatively necessary. This is at all times a difficult, and even under the most favorable circumstances, an imperfect operation, and when this deposit coats the surfaces of the flues, the consumption of fuel is increased to an extent unsuited to the economy of mercantile enterprise and to the duration of operation requisite for naval purposes.

This evil may be avoided by furnishing the boilers with a full supply of fresh water, and as the weight could not be accommodated, nor the space spared in a vessel for an instrument and its fuel for the sole purpose of distilling the quantity required, it is obvious that the steam furnished by a boiler must be returned to it, after being condensed by the radiation of its heat to cold surfaces, and not by the admixture of water. This method was *proposed* by James Watt, so early as the year 1776, and has been effected to some extent by an instrument invented by Mr. Samuel Hall, of England, and applied to the engines of many steam vessels, in some of which, notwithstanding its imperfections, it is yet used. It has failed, however, to answer the full purposes desired and anticipated.

In the arrangement of Mr. Hall a great number of thin metal tubes, from one-half to three-fourths of an inch in diameter, were placed *vertically* in a condenser and exposed to a current of cold water from the sea and into which the steam from the cylinder was admitted, for the abstraction of its heat by the radiation of it to the water without the tubes. Now it is evident, that, by this arrangement, the condensed steam would run down the inner surface of the tubes, in its passage presenting a non-conducting lining to them, and in its collection at their bottom an obstacle to the current of the steam and a diminution of the effective radiating surface.

With this method of condensation, it will be perceived that this instrument provides alone for returning to the boiler, the water that has passed through the engine as steam. It follows, then, that all escapes of steam from the boiler or engine, or water-leaks from the boiler, pipes, &c., must be replaced by distillation, at an expense of fuel, directly as the evaporation. Further continued use of this instrument exhibited an oleaginous deposit upon the inner surface of the tubes from the use of oil and tallow in the steam cylinder and on the valve faces, which, acting as a non-conductor, materially obstructed the condensation of the steam.

The apparatus of Captain Ericsson was designed to obviate the difficulties and deficiencies developed in that of Mr. Hall, and is composed of two distinct instruments, a Condenser and an Evaporator; the first for the purpose of condensation, and the latter for a supply of fresh water to provide for any losses of steam or water from the boiler by escapes, leaks, gauge vents, &c., &c.

The Condenser is a cylindrical vessel set at a slight inclination from a horizontal line, containing the requisite extent of radiating surface in metal tubes of *two inches* bore, with an open space at each end. By this arrangement there is free space for the current of steam to pass and for the condensed steam to run down the lower side of the tubes, without presenting a lining of water to intercept radiation or an obstruction to the course of the steam. Connected with this is a

pump, by which water from the sea is drawn in and forced through the spaces between the tubes and the inner surface of the shell of the condenser. Thus, the latent heat of the steam is absorbed by contact with the tubes, and condensation is effected for the double purpose of affording a vacuum for the engine and of restoring fresh water to the boiler, for continuous evaporation and condensation, to meet the requirements of the engine.

The Evaporator, as constructed, is a parallelopipedon with a semi-cylindrical top and bottom, the lower portion of which is occupied by a number of tubes similar to those in the condenser, which communicate with a valve at each end of the steam cylinder, worked by the engine: around these tubes, and for some distance above them, water from the sea is admitted for the purpose of being evaporated, and the space above this water is open to the condenser and consequently *in vacuo*. This instrument being designed to furnish fresh water to replace that which may be lost, its operation is resorted to only as occasion may require, and is effected in the following manner: when the piston is near the termination of its stroke the valve referred to opens, (above or below as the case may be,) and closes when the piston begins its return stroke; by this arrangement, steam is withdrawn from the engine that has very nearly performed its full expansive effect, and passing into the tubes of the evaporator its heat is absorbed by the water surrounding them, and as this water is *in vacuo* it readily boils at a low temperature, and its vapor being led to the tubes in the condenser, it is condensed with the steam from the cylinder and is supplied to the boiler.

Upon the experimental trial to which you were pleased to request our attention, all practicable arrangements for correct observations were entered into; and with a view to acquire full and progressive notes of the operations of the apparatus, the observations of the various points were confided to special committees, which upon the conclusion of the trial, reported full notes for furnishing the following, viz:

The boiler was filled with fresh water from above the opening of the blow-off cock; below this, salt water had been left, from an impression of its effect being too inconsiderable to authorise its removal.

At the commencement of the operation of the engine, the water in the boiler as indicated by a saline hydrometer, when at a temperature of 150° Fahrenheit, was $\cdot\frac{3}{32}$.*

The highest temperature of the *feed water* observed was 158° Fahrenheit.

The lowest 132°, and the average 150°.

The highest *vacuum* observed was from 16 to 18 inches.

The lowest from 11 to 15, and the average was from 12 to 15 inches.

The highest *steam pressure* was 54 lbs. mercurial gauge.

The lowest was 20 lbs., and the average was 48·6 lbs.

The highest number of *revolutions* was 47 per minute.

The lowest number was 30, and the average 42·3.

The point of cutting off was at three-eighths of the stroke.

The temperature of the sea water was 57.

* 12-32 being the point of saturation of water when at a temperature of 200°.

Duration of *operation* of the engine and boiler 14 hours and 20 minutes.—Time during which steam was raised, 20 hours.

DIMENSIONS OF ENGINE, &c.

Cylinder.—36 inches in diameter, with a stroke of piston of 32 inches.

Boiler.—	1400 square feet of heating surface.
Condenser.—	637 square feet of radiating surface.
Evaporator.—	100 square feet of heating surface.

Upon coming to, the freshness of the water was again tested, and when at a temperature of 150° by a different thermometer than that used at the first operation, (it having been broken in the interim,) the hydrometer indicated $\cdot\frac{7}{32}$; whether this difference in the indications is to be attributed to a change in the density of the water or to a difference in the thermometers, they being of different manufactures, we are unable to decide; fortunately the difference is quite inconsiderable, and is not regarded as deserving of further consideration.

So soon as the temperature of the Condenser was reduced to a degree that rendered an examination of it practicable, one of its heads was removed in our presence, and the tubes, when examined, were entirely free from any deposit or incrustation upon their surfaces, and the opinion is entertained, that at a temperature of feed water commensurate with economy of fuel, any difficulty from the deposit of oleaginous matter in this instrument is not to be apprehended.

Regarding the particular performances of the Condenser and Evaporator, it appeared that Capt. Ericsson had relied too confidently on a general current of the cold water through the former instrument, whereas the current was quite partial, being but directly through its narrowest part, the sides of it: hence, the upper portion of it was almost inoperative—this feature was clearly developed by the application of a hand along the surface—while the effect of it was apparent in the moderate condensation indicated by an attached mercurial gauge.

Of the Evaporator, its capacity was clearly shown, in the facility with which the level of the water in the boiler could be raised through the space between two gauge cocks, and by a resort to its operation not being necessary for more than one-tenth of the time.

Immediately after the close of this trial, measures were taken to effect a diffused operation of the cold water, and as diaphragms could not be introduced between the tubes to alter the current of the water, without incurring an impracticable delay, the expedient of causing the steam to circulate through the tubes was resorted to, and was effected by the application of diaphragms in the open space at each end of the tubes. Upon the completion of this, a further trial was had on Friday, the 1st inst., when several observations furnished the following:—

Pressure of steam,	50 pounds mercurial gauge.
Revolutions,	47 per minute.
Vacuum,	20·5 inches.
Temperature of feed water,	150° Fahrenheit.
Temperature of sea water,	62° "

Compared with the ordinary method of condensation, the value of the method observed is determined by an investigation and consideration of the following points, viz.: Evaporation, Pressures, Consumption of Fuel, Safety and Duration of the Boiler.

1.—Evaporation. *Ordinary Method.*

Temperature of Feed Water, 100° *Fahrenheit.*

Temperature of sensible and latent heats of steam,	1192°
Deduct temperature of feed water, - -	100°
Heat to be added, - - -	1092°

New Method.

Temperature of Feed Water, 150° *Fahrenheit,*

Temperature of sensible and latent heats, -	1192°
Deduct temperature of feed water, - -	150°
Heat to be added, - - - -	1042°

Then $\frac{1042}{1092} = \frac{\cdot 954}{1\cdot 00}$ which represents a gain in the evaporating temperature in the new method of 4·56 per cent.

2.—Pressures. *Ordinary Method.*

Pressure of steam—mercurial gauge, -	50 lbs.
Vacuum, 28 inches, - - -	=13·7 lbs.
	63·7 lbs.

Cut off at three-eighths of the stroke.

Effective pressure on the piston, - =47 lbs.

New Method.

Pressure of steam, - - -	50 lbs.
Vacuum, 20·5 inches, - - -	=10 lbs.
	60 lbs.

Effective pressure on the piston, - 44·5 lbs.

Then $\frac{47}{44\cdot 5} = \frac{1\cdot 05}{1\cdot 00}$ which represents a loss in pressure by the new method of 5 per cent.

3.—Consumption of Fuel. *Ordinary Method.*

In the Gulf of Mexico and between the Tropics, it is necessary to blow off, when a hydrometer constructed similar to the one already referred to indicates $\frac{2}{32}$; in the Northern and Southern Atlantic and Pacific oceans, when it indicates $\frac{2\cdot 5}{32}$. Hence $\frac{2\cdot + 2\cdot 5}{2} = 2\cdot 25$ the average point for blowing off.

As the average degree of saturation of feed water is $\frac{\cdot 75}{32}$; the quan-

tity of water blown off compared to that fed to a boiler is as ·75 to 2·25, which is in the proportion of 1 to 3.

Temperature of the water blown off at the pressure and degree of saturation given, 290°

Deduct temperature of feed water, 100°

Temperature lost by blowing off, 190°

As the heat to be added for the purpose of evaporation is 1092°—1092 × 3—1, the proportion of feed water evaporated, = 2184°

And 190 × 3—2 the proportion of feed water blown off, 190°

The heat absorbed, is, 2374°

Then $\frac{190}{2374} = \frac{.08}{1.00}$ which represents the loss of heat by blowing off in the ordinary method of 8 per cent.

SUMMARY OF RESULTS.

Gain by Evaporation, - - -	4.56	per ct.
Do. do. Consumption of fuel, - -	8.00	"
	12.56	"
Loss by Pressure, - - -	5.00	"
Total,	7.56	"

Which is a saving in the expenditure of heat, affording a like economy in the consumption of fuel and altogether independent of the loss of heat, by the presence of scale in a boiler, when salt water is used, and from leaks incurred by the oxidizing effects of salt water.

With the *Ordinary Method*, the level of the water in a boiler is constantly varying from one or both of the following causes, viz: the quantity of the water blown off, or the particular extent of opening of the feed valve; while the effective operation of the feed pump and neglect of the blow-off valve, involves the burning, or an explosion of the boiler.

With the *New Method*, these operations are set aside, thus, blowing off is unnecessary, and the supply to the boiler being first obtained from it, the transit being immediate and the communication incapable of restriction, (for if the condensed water was not taken off by the feed pump, the condenser would choke and become inoperative,) there can be no decrease in the level of the water, other than that arising from leaks of water and steam. Further, the use of fresh water in a boiler will extend the term of its duration from three and five years to seven and nine.

With a further modification of the condenser, establishing a more diffused current of the cold water, it is evident that a full vacuum may be obtained, as the practicability of attaining this end by external condensation, has long since been developed, and with a less proportion of radiating surface than is exposed in the instrument referred to. From the analysis however here given regarding pressures

and temperatures, it would appear that a full vacuum, with corresponding reduction of the temperature of the feed water is not authorized; and as such departure from the hitherto practice, furnishes the temperature necessary to prevent any oleaginous deposit upon the surface of the tubes of the condenser, practice and utility are in desired harmony.

A very effective and economical element in steam navigation arises with the operation of this new method, from the absence of scale in the boiler, the presence of which is unavoidable where salt water is used, and to avoid the formation of it as far as practicable, other than a low temperature and corresponding pressure are precluded by the waste of fuel and injury to the boiler consequent upon the existence of this scale, acting as a new conductor of the heat to the water—whereas, with the use of fresh water, higher pressures can be worked and economy of fuel attained in an increased expansion of the steam.

Reviewing the facts herein presented, we are of the opinion that the operation of the apparatus of Captain Ericsson, as far as developed, was eminently successful, and that, with the modification of the condenser suggested, a higher degree of vacuum can be readily obtained. In view of the very great importance of the successful introduction of this method of condensation in the merchant and naval services, we recommend to your consideration the propriety of sending the Legaré on a distant cruise, for the purpose of developing the advantages of the apparatus by continued and extended use.

Apprised of the ready attention you have given to this important subject, and the zealous interest you have manifested in its development, we cannot but congratulate ourselves and the profession with which we are connected, that you have seen fit to test this improvement by the construction of the apparatus on which we have been called to report. Such encouragement identifies in the merits of success the patron with the improvement, and is honorable to yourself no less than the nation in whose service you have bestowed it.

We have the honor to be, very respectfully,

Your obedient servants,

CHAS. H. HASWELL,
Engineer-in-Chief, U. S. N.

JAS. J. MAPES, *New York.*

LEWIS TAWS, *Philadelphia.*

JAMES MCFARLAN, *Union Ferry Co. N. Y.*

J. H. TOWRE, *Philadelphia.*

WM. SEWELL, SR., } *Chief Engineers,*
WM. W. W. WOOD, } U. S. N.

To the Hon. ROBT. J. WALKER,
Sec. Treas., U. S.,
Washington, D. C.

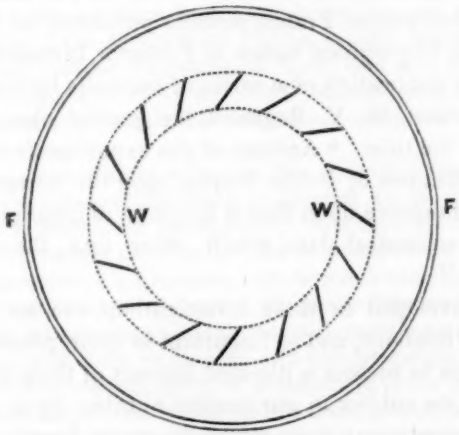
Remarks on the Centre-vent Reaction Water Wheel, by Z. PARKER.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE

In my notes of the experiments on the centre-vent-reaction wheel at Troy, I mentioned the fact of the small amount of water discharged, in proportion to the aperture, and of its disposition to uniformity under all velocities of the wheel.

I might have stated that in all cases in which the vanes of the wheel direct the water nearly tangentially to the inner circle of the annular rim of such wheels, the quantity discharged, (under circumstances of full supply,) appears to be about 50 per cent. of the theoretic discharge; and that this proportion appears to be but little affected by changes in the velocity of the wheel, from being held stationary, to any velocity it may acquire by the pressure of the water on the vanes;—or by any change in the circular motion of the water entering the wheel, (at its verge,) either with or contrary to the circular motion of the wheel.

In corroboration of this position, we have the experiments at Troy, in which the discharge (at the maximum) was a trifle less than 50 per cent., owing probably to the unfavorable form of the vanes;—and the 4th set of my model improvements, (the notes of which you have,) where the water passed, inwardly, through a structure, which, when the wheel was removed, was exactly similar to such a wheel,—the quantity discharged in this instance, being just 50 per cent. of the theoretic discharge.



F F Glass Flumes. W W Wheel.

Among the many "interesting objects" at the American Institute Fair, of the present season, there was a centre-discharge-reaction wheel, in a very neatly constructed model, the wheel, about 4 inches in diameter, being made of brass and neatly finished. To the under side of a disk, attached to a vertical shaft, were attached plane vanes

extending from the verge to a circle about one-half of an inch from the verge. To these vanes was attached the annular rim, in the usual way. The angle of the vanes directed the water somewhat within the direction tangent to the inner diameter of the annular rim, and after passing into the wheel, it fell through the opening of the rim, and bottom of flume some inches, into a basin beneath. The flume was a glass cylinder about seven inches diameter;—and the supply, a constant stream of "Croton" through a lead pipe,—falling in from the top of the cylinder.

Suspecting from my former experiments that the discharge of such a wheel must be uniform under all velocities, I took the opportunity of experimenting on this, by applying friction to the shaft (about half an inch in diameter) with my fingers. *I could make no sensible variation in the height of surface by any change of velocity, from being held, to running it beyond its natural free velocity, (by rolling the shaft between my thumb and fingers,) nor by turning the wheel backward.*

The accompanying cut represents a section of the vanes.

Philadelphia, November, 1847.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines, by M. V. Regnault.

The 21st volume of the Memoirs of the Royal Academy of Sciences of the Institute of France recently published is (with the exception of the biographical notice of Professor Blumenbach) entirely devoted to the publication of a series of memoirs by the distinguished experimentalist, M. V. Regnault, the general object of which is thus stated in the title: "Account of the experiments undertaken by order of the Minister of Public Works, upon the recommendation of the Central Committee upon Steam Engines, to determine the principal laws and numerical data, which enter into the calculation of steam engines."

The facts developed in these investigations, are so interesting in their scientific relations, and so important in their practical bearings, that we propose to present a digested account of them to our readers, and introduce the subject in our present number by a translation of the author's introduction, from which the exact direction of his labors and the simple theory which they are to render applicable to practice, will be clearly seen. Com. Pub.

Introduction.

The theoretic calculation of the work done by steam engines, is founded upon some incontestible principles of general mechanics, and upon several physical laws which are far from having been, up

to this time, established upon certain bases. The authors who have written upon the theory of these machines, have been obliged to admit as the basis of their calculations, laws which ought only to be considered as hypotheses to which physical philosophers have been led, most frequently, by extending to vapors, laws which are not even rigorously exact for permanent gases. Thus, when the work really done by a machine is compared with that deduced from the theory, we always find, even in the best machines, a considerable deficit. A great part of this deficit may be attributed to the disturbances produced in the physical conditions, by the very motion of the apparatus; it is due to the loss of active force *(force vive)* occasioned by the cooling of the steam; to the resistance which is developed during its course through tubes of irregular forms, and in its passage through openings, more or less contracted. Finally, there are losses of active force produced by the friction and vibration of the different pieces of which the machine is composed. But a great part of the difference may well be occasioned by the inaccuracy of the fundamental laws which have been admitted into the calculation.

Mechanics have, for a long time, greatly desired a general investigation for the purpose of establishing these fundamental laws upon a series of direct experiments executed with the means of precision which physical sciences now present. I had for some time formed the determination of devoting myself to this work, and had several times tried some introductory experiments, which however, served only to show me that precise results could only be obtained by means of large apparatus, whose expense of construction far surpassed the very narrow means which we have at our disposition in our physical laboratories, and I should have been completely stopped in the execution of my projects, if the Minister of Public Works, upon the suggestion of M. Legrand—under Secretary of State, had not, with a kindness which will be appreciated by all the friends of science, placed at my disposal the funds necessary for the execution of this long and laborious work.

In order to show clearly what are the principal laws upon which the theory of steam engines rests, it appears to me necessary to explain, in a few words, the principles of this theory. All known systems of steam engines may be divided into four classes:

1. Engines without expansion, and without condensation.
2. Engines with expansion, and without condensation.
3. Engines without expansion, but with condensation.
4. Engines with both expansion and condensation.

The first three classes, may, in a theoretic point of view, be considered as particular cases of the fourth class, which presents the most complex case; the only one to which it is necessary for us to pay attention. We shall suppose an imaginary engine, which is not subjected to any external cause of cooling, nor to any loss of active force by friction, contractions of orifices, &c., &c We shall suppose the boiler to be of very great capacity in comparison with the cylinder, so that the pressure of the steam may be considered as absolutely constant in the boiler during the motion of the machine, the heat of the fur-

nace reproducing, constantly, the quantity of steam consumed by the machine.

Let ω be the surface of the piston expressed in square metres. *

x, the space described by the piston from the instant of the arrival of the steam in the cylinder, with the tension which it has in the boiler, until the moment at which we are examining it.

P, the constant pressure of the steam in the boiler, expressed in kilogrammes and referred to a square metre of surface.

T, the temperature of the steam.

v, the capacity, in cubic metres, of the part of the cylinders described by the piston from its starting point to the height, x.

V,' the total capacity of the cylinder.

I. A first law, which it is important for us to know, is *the law which connects the elastic forces with the temperatures.*

We will distinguish two periods during the stroke of the piston: during the first of these the cylinder communicates freely with the boiler; the total pressure of the steam upon the surface of the piston is $P\omega$.

If the piston advances by a quantity dx, the element of work produced will be, $P\omega dx = Pdv$.

The whole quantity of work produced during the first period, that is, from the beginning of the motion of the piston until the introduction of the steam is stopped, (corresponding to a capacity V, described by the piston in the cylinder,) is P V.

During the second period, which is that of the expansion, no more steam comes from the boiler, but the steam contained in the cylinder continues to press upon the piston; as this rises, the steam occupies a larger space, its elastic force diminishes, and its temperature is lowered by the absorption of latent heat during its dilatation.

Experiment has not decided what are the laws which govern these variations; but one of the following cases must happen:

First case. The quantity of heat absorbed by a kilogramme of liquid water at 0° (32° Fah.) in passing into vapor, (which, for the sake of simplicity, we shall call, *the total heat of the steam,*) is the same, whatever may be the pressure, provided the vapor be at its maximum of density. If this law be exact, the steam will always remain in a state of saturation during the whole period of the expansion; the pressures of the steam will vary in the inverse ratio of its volumes, and they will constantly present the relations to the temperatures, which connect the temperatures of saturated steam with its elastic forces.

Second case. The total heat of the steam increases in proportion as its elastic force is greater. As we suppose that the steam is not subjected to any external cooling influence, it is evident that, in proportion as the steam dilates into a larger space, it will require a

* In the following translation we have preserved the French units of length, weight, and temperature. The metre is 39·371 inches. The kilogramme 2·205 lbs., av.

The degree of the Centigrade thermometer, 1·8 degrees Fahrenheit.

To reduce Centigrade to Fahrenheit degrees, multiply them by 9, divide the product by 5, and add 32°.

smaller quantity of total heat to keep it in the state of vapor. Consequently, during the dilatation, there will be a disengagement of a certain quantity of latent heat, which will become sensible to the thermometer, and will raise the temperature of the steam above the point which corresponds to its saturation. The temperature of the steam will then be more slowly reduced than in the former case ; the steam will be found overheated during the expansion, and the pressure of the steam upon the piston will diminish more slowly than it would according to the law of Mariotte.

Third case. The total heat of steam is less in proportion, as its elastic force is greater. If this law were true, there would be a precipitation of liquid water during the expansion, the steam would remain constantly saturated, but the elastic force would decrease more rapidly than according to the law of Mariotte.

In the absence of decisive experiments to shew the accuracy of one of these three hypotheses, mechanicians have generally adopted the first, which is at the same time the most simple and the most precise. This hypothesis assimilates the expansion of steam to that of a permanent gas, dilating in a variable space, whose walls constantly restore to the gas the quantity of heat which is absorbed in the latent state during its expansion, so that its temperature remains invariable.

The work developed during the expansion is then calculated in the following manner: Let v be the volume of the steam, and p its pressure at a given moment; dx the space described by the piston, while the volume becomes $v+dv$; the element of work produced will be $p\omega dx=pdv$. At the commencement of the expansion, the volume is V, and the pressure P, and as we admit the law of Mariotte between the volume of the steam and its elastic force during expansion, we shall have

$$p=\frac{\mathrm{PV}}{v}, \quad =pdv=\mathrm{PV}\frac{dv}{v}$$

and the whole work produced, while the volume of the vapor passes from V to V', is $\int_{\mathrm{V}}^{\mathrm{V}'} \mathrm{PV}\frac{dv}{v}=\mathrm{PV}\log.\frac{\mathrm{V}'}{\mathrm{V}}=\mathrm{PV}\log.\frac{\mathrm{P}}{\mathrm{P}'}$

This is the expression for the work produced during the period of the expansion. The total quantity produced during a complete stroke of the piston, is then,

$$\mathrm{PV}\left(1+\log.\frac{\mathrm{P}}{\mathrm{P}'}\right)$$

We have heretofore attended only to the pressure which is exerted upon one of the faces of the piston, but the other face is constantly submitted to the pressure which exists in the condenser. We will suppose this latter pressure to be constant during the stroke of the piston, and represent it by f. The amount of resistance which it will have produced during the stroke of the piston, will be

$$f\mathrm{V}_1=f\frac{\mathrm{VP}}{\mathrm{P}_1}$$

So that the moving power will be expressed by

$$\mathrm{PV}\left(1+\log\frac{\mathrm{P}}{\mathrm{P}_1}-\frac{f}{\mathrm{P}_1}\right)$$

If n represents the number of strokes of the piston per minute, the power developed during this unit of time, will be expressed by

$$nPV\left(1+\log.\frac{P}{P_1}-\frac{f}{P_1}\right)$$

But the accuracy of the formula depends upon the accuracy of the hypothesis which we have admitted, and it is necessary to determine by direct experiments.

II. *The quantities of heat which must be given to a kilogramme of water, at 0°, to vaporize it, under different pressures.*

These quantities of heat are composed of two distinct parts—the heat necessary to raise the temperature of the liquid water from 0° to the point at which the change of state takes place, and the latent heat of vaporization. If we wish to distinguish these two parts of the total heat of steam, we must determine by experiment—

III. *The capacity for heat of water at different temperatures.*

Finally, if the total heat of steam is not constant under all pressures, in order to calculate the effect of expansion, we must still learn—

IV. *The specific heat of the vapor of water in different states of density, and at different temperatures.*

The theoretic power of a steam engine may be estimated, by stating the amount of power which it is capable of giving for each kilogramme of steam consumed.

To do this, let ϖ be the weight of a cubic metre of steam under the pressure P, and at the temperature T, π the weight of steam consumed by the machine in one minute. We shall have $nV=\frac{\pi}{\omega}$, and consequently the power given by the machine, from a kilogramme of steam, will be expressed by $P\frac{\pi}{\varpi}\left(1+\log.\frac{P}{P_1}-\frac{f}{P_1}\right)$

But in order to calculate, under all circumstances, the value of ω, we must know—

V. *The law according to which the density of saturated vapor of water varies under different pressures;*

VI. *The co-efficient of dilatation of the vapor of water, in its different states of density.*

Mechanical philosophers generally admit that the weight (ϖ) of a cubic metre of steam, under the pressure P, and at the temperature T, may be calculated by applying to saturated steam the law of Mariotte, and the law of the uniform dilatation of gases. Now, these laws are not even rigorously exact for the permanent gases, and it is to be feared that they are completely false for saturated vapors. Finally, the method most generally adopted to compare steam engines, consists in stating the work which they perform for each kilogramme of fuel consumed. To do this, we must know the weight (K) of steam under the pressure P, which a kilogramme of the fuel can develope under the circumstances in which it is employed; and we then have, for the work performed by a kilogramme of fuel,

$$P_1K\frac{\pi}{\varpi}\left(1+\log.\frac{P}{P_1}-\frac{f}{P_1}\right)$$

The quantity K, depends upon a variety of circumstances which we

cannot now discuss, such as the quality of the fuel, the nature of the furnace, the arrangements of the boiler, &c., &c., &c.

To sum up then, the theoretic calculation of steam engines requires the knowledge of the following laws and data:

I. The law which connects the temperatures and elastic forces of saturated steam.

II. The quantities of heat which one kilogramme of liquid water at 0° absorbs, in being converted into saturated steam, under different pressures.

III. The quantities of heat which one kilogramme of liquid water at 0° requires to elevate its temperature to that at which it assumes the state of steam, under different pressures.

IV. The specific heat of aqueous vapor, in different states of density, and at different temperatures.

V. The law according to which the density of saturated steam varies, under different pressures.

VI. The co-efficients of dilatation of steam, at different densities.

Before commencing the search for these different laws, it was necessary to treat several preliminary questions, so as to fix with certainty, the indispensable auxiliary data, and, above all, to define clearly the conditions which must be fulfilled by the thermometers, by means of which we measure the temperatures, in order that these instruments may be rigorously comparable.

These preliminary researches obliged me to undertake, successively, long series of experiments, the necessity of which I was far from foreseeing when I undertook the work. I was in fact obliged to undertake the re-determination of a great number of data, which, for the most part, appeared to be fixed with complete certainty, by the researches of my predecessors, and as to which physical philosophers entertained no doubts whatever.

The whole of these researches will be published in a series of detached memoirs. I intend, at the end of my labors, to sum them up in a report, which will be addressed to the Minister of Public Works, in which the results will be presented under a form suitable to the especial view with which the work was undertaken—that is, the theoretic calculation of steam engines.

My experiments frequently required the assistance of a great number of observers. I was frequently obliged to avail myself of the kindness of several of my students, among whom it gratifies me to cite especially Messrs. Bertin, Grassi, Bertrand, Lissajoux, and Silberman. Let me be permitted to return to them, thus publicly, my thanks.

But I must, in a very especial manner, testify my gratitude to my friend M. Izarn, for the zeal and complete devotion with which he has aided me in this long series of labors, some of which were not without danger, and all were very troublesome, as well as in the long and tedious numerical calculations which were the consequence of them. By the aid of his active co-operation, I have been able to terminate these labors in much less time than it would have been possible for me to have done it, if I had been reduced to my own personal efforts alone.

(To be Continued.)

On the decomposing power of Water at high temperatures, by Richard A. Tilghman, Read before the American Philosophical Society, Philadelphia, August 20, 1847.

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It has long been noticed, that partial decomposition is often effected in attempting to render anhydrous, by heat, certain salts which require a comparatively high temperature for the expulsion of their watery crystalization. This effect is not limited to those salts which are capable of decomposition by the action of heat alone, but extends to many which, when previously rendered anhydrous, are entirely unaffected by this agent. The chloride of magnesium offers a striking instance of such an action, being almost entirely reduced to magnesia, with escape of hydrochloric acid, when its solution is evaporated by a strong heat; the anhydrous chloride, when obtained by other processes, is, on the contrary, unaffected by the highest heat.

Even chloride of calcium, a salt of much stronger radical base, has been observed to give off a portion of acid, when all its water of crystalization is driven off by a red heat. In these and many other instances, it seems evident that the escaping water of the salt is the actual decomposing agent, and that the intensity of its action depends solely upon the degree of heat which the salt can sustain before giving it off.

Contact of the salt and water, at high temperatures, appears to be the only requisite of decomposition. It was therefore thought probable, that by exposing the salt, even in its anhydrous state, to a high heat, and passing over it a current of aqueous vapor, raised to a similar temperature, not only might the above mentioned salts be completely decomposed, but also that many others which have hitherto given no such signs of partial decomposition, might be acted upon in a similar manner.

On making the experiment, it was found, that not only the anhydrous chloride of calcium, but also the chlorides of strontium and barium could be rapidly decomposed by exposing them, at a high red heat, to a current of steam; hydrochloric acid was copiously evolved, and escaped along with the excess of steam, while the bases of the respective salts were left in a free state; the lime remaining anhydrous from the intensity of the heat employed, while the baryta and strontia combined with a portion of aqueous vapor, and were found in the state of hydrates.

In these haloid salts, it is to be observed, that the addition of the elements of water is absolutely essential to the decomposition; as neither the hydrogen which is contained in the acid, nor the oxygen in the base, existed in the anhydrous salt. The action is, therefore, the result of a double decomposition between the steam and the chloride, as well as of the affinity of the liberated acid and base for water.

The oxysalts, and the sulphates of magnesia, lime, strontia, and baryta, unlike the haloid salts just mentioned, contain, even in the anhydrous state, all the elements generally considered necessary for the separate existence of the acid and bases of which they are com-

posed. The application of the strongest heats to these salts, causes, however, no liberation of their acid; but, as with the chlorides, this effect is immediately produced by the passage of a current of steam over them at a high temperature, the baryta and strontia being left in the state of hydrates, and the other bases anhydrous.

The intensity of the affinity between the acid and base of the respective salts, is curiously illustrated by the gradual increase of the heat necessary for their decomposition by the aqueous vapor.

Thus the sulphate of magnesia gives off its acid to the current of steam at a low red heat, and consequently a large portion of the acid may be condensed in an undecomposed state. The sulphate of lime requires a high red heat for its decomposition, and on this account the greater part of its acid is resolved into sulphurous acid and oxygen gas. The decomposition of the sulphates of strontia and baryta, requires progressively higher heats, which, in the case of the last salt, must be raised even to low whiteness.

The subphosphate of lime, as it contains an acid much less volatile than sulphuric, combined with an excess of a powerful base, which adds to its stability, was selected as one of the most difficult tests of this decomposing power of aqueous vapor: by a full white heat, however, its phosphoric acid was slowly disengaged. This phosphoric acid gave a white precipitate with nitrate of silver, showing that its liberation and subsequent condensation in contact with a great excess of aqueous vapor, had not prevented that change which heat is known to produce upon this acid.

It might be expected from the decomposition of the salts of baryta, that the sulphates and muriates of potash and soda would undergo the same change with even greater facility. But it was found by experiment, that although the decomposition of these last salts commenced with facility, when they were exposed to steam at a red heat, yet the proportion of alkali thus liberated, never exceeded a very small per centage of the residual salt, however long the operation might be continued. Attributing this peculiarity to the volatile nature of the liberated hydrates of potash and soda at high temperatures, substances capable of forming non-volatile combinations with the alkalies, were mixed with their salts, previously to subjecting them to the action of the steam; the acids were then found to be completely disengaged with facility. The fact that both lime and magnesia, substances capable of forming chemical combinations of but the most feeble character with potash and soda, were found to produce the above effect, was considered as confirming, in a great measure, the hypothesis that the volatility of their hydrates was the cause of the apparent difficulty of completely decomposing the salts of these alkalies.

The subphosphates and subsilicates of lime, baryta, and strontia, act in the same manner as lime and magnesia, and in all these cases the chemical combination is so feeble that, when cold, the alkali is disengaged by the solvent powers of water alone.

Alumina, which possesses so much of the acid character with respect to the strong bases, is proportionably more efficient than any of

the preceding substances in aiding the decomposition of the alkaline salts: it remains in combination with the alkali, when cold, as a soluble aluminate; but is easily precipitated from its solution by a current of carbonic acid gas.

The calcination of potash alum, leaves a mixture of alumina and sulphate of potash, which Berthier has long since stated to be converted into aluminate of potash by the continued action of heat alone, the sulphuric acid being expelled from the potash by the superior affinity of the alumina at a high temperature. By several careful repetitions of his experiment, in which the accidental presence of aqueous vapors was entirely prevented, no decomposition of this kind could be effected, even at a white heat. But by the contact of aqueous vapor, produced by the combustion of the fuel or otherwise, even in small quantity, and at much lower temperatures, the decomposition is rapidly produced. It therefore seems probable that the accidental contact of aqueous vapor was the actual but unnoticed cause of the decomposition in Berthier's experiment.

The powerful action of aqueous vapor upon anhydrous alum at a high temperature, suggested the possibility that a similar action might take place upon its mineral representative, the double silicate of alumina and potash, or common felspar. It will be remembered that this salt, by the simple substitution of sulphuric for the silicic acid which it contains, would be converted into anhydrous alum. To the action of heat alone, felspar presents this difference from alum, that the silicate of alumina is as unaffected by it as the silicate of potash itself; so that to produce an effect upon felspar analogous to that upon alum, the silicic acid of both the silicate of alumina and of the silicate of potash would have to be removed. Silicic acid, in a *free* state, having been long known to be slightly volatile in aqueous vapor at high temperatures, it was thought that, in the present case, it might, like the other acids, be disengaged even from a state of chemical combination, by the same agents. Steam was therefore passed slowly, for some time, over small fragments of highly heated felspar. Beyond partial fusion, no other visible change than a considerable degree of vesicularity in the parts most exposed was produced. These fragments, being finely pulverized and boiled in water, the concentrated solution was strongly alkaline, and proved, by the usual tests, to consist of aluminate of potash.

After water ceases to extract aluminate of potash from the powdered mineral, dilute sulphuric acid will produce from the residue a small portion of alum. The actual analogy between alum and felspar, substances so distinct in their origin and general properties, yet differing only in the nature of their respective acids, is rendered still more striking by both thus yielding the same product, when deprived of their acids by the same agent. It is worthy of remark, that, although the actual contact of the steam in this experiment is confined to the mere surface of the small fragments of felspar, yet the chemical decomposition produced by it is not confined to that surface, but spreads by a "cementation action," through their entire mass: pulverization is, therefore, required to obtain evidence of the internal change which has been produced.

All the experiments, so far made, would indicate that the following was the general rule applicable to all salts capable of sustaining heat alone without decomposition:

Whenever a salt, from its own elements alone, or by the addition of those of water, can produce a volatile acid and a fixed base, the evolution of this acid and the liberation of this base will be determined by passing a current of aqueous vapor over the salt raised to a high temperature. When either the acid or base to be liberated forms a combination with water which can resist decomposition by the heat employed, the tendency to form such hydrates adds much to the decomposing power of the aqueous vapor. Although potash and soda are not by themselves fixed bases at high temperatures, yet by the use of the substances before mentioned, they can form combinations which are fixed, and by this means their salts come under the above rule.

The actual number of salts which have as yet been subjected to this mode of decomposition, is not very large; yet, from their perfect analogy of composition with many others, there can be but little doubt of the general extension of the principle.

The chlorides of potassium, sodium, barium, strontium, and calcium, being all thus decomposed, the bromides, iodides, and fluorides of the same and all weaker bases, must probably act in the same manner. The fluoride of calcium, has, in fact, been found to do so, by experiment, hydrofluoric acid being freely evolved. In the same manner, from the decomposition of the sulphates, may be inferred that of the seleniates; from the silicates, that of the borates.

The applicability of this simple mode of decomposition to the explanation of a great variety of geological changes, is too evident to escape the attention of those conversant with that science. In a future paper I hope to be able to give a more complete account of some interesting facts which have been observed in connexion with this subject, and to verify, by experiment, many points which must at present be left to inference and conjecture. In fact, although the existence of this law of decomposition was ascertained in 1842, yet it has only been within a few months that I have been able to give much attention to its investigation, which must be my excuse for the imperfect and hurried manner in which it is now communicated.

London, August 3, 1847.

Note on the means of testing the comparative value of Astringent Substances for the purposes of Tanning, by Robert Warrington, Esq.

Having been frequently called upon to examine the value of astringent substances imported into this country for the purposes of tanning, such as valonia, divi-divi, sumac, cutch, &c., I am induced to believe that the detail of the manipulation adopted may not be without interest to some of the members of the Society. As the manufacture of leather was the object of the purchaser of these materials, gelatin

was selected as the basis for the estimation of their comparative value; and after several trials with various kinds of natural and manufactured gelatin, such as varieties of isinglass, glue, patent gelatin, &c., the finest long staple isinglass was found to be the most constant in its quality, and least liable to undergo change.

With this, therefore, the test solution was prepared, of such a strength, that each division, by measure of the ordinary alkalimeter tube, should be equivalent to the one-tenth or one-fourth of a grain of pure tannin, and thus the number of divisions used would indicate the proportion of available tannin or substance precipitable by gelatin contained in any specimen. A given weight of the sample under trial was then infused in water, or if necessary, the astringent matter extracted by boiling, and the clear liquid precipitated by the test solution, until no further deposit occurred.

It was necessary in the course of this operation, to test at intervals a portion of the solution under examination, to ascertain the progress of the trial; and this, from the nature of the precipitate, was attended at first with some little difficulty: paper filters were inadmissible, from the quantity of the solution they would absorb, and thus introduce a source of extensive error; subsidence rendered the operation very tedious. The plan I have adopted is as follows:—a piece of glass tubing, about twelve inches in length and about half an inch internal diameter, is selected, and this has a small piece of wet sponge loosely introduced into its lower extremity, and when it is wished to abstract a part of the fluid under investigation for a separate testing, this is immersed a few seconds in the partially precipitated solution; the clear liquid then filters by ascent through the sponge into the tube, and is to be decanted from its other extremity into a test glass; if, on adding a drop of the gelatin solution to this, a fresh precipitate is caused, the whole is returned to the original bulk, and the process proceeded in, and so on until the operation is perfected; this method of operating is facilitated by conducting the examination in a deep glass. After a few trials the manipulation will be found extremely easy, and in this way considerable accuracy may be arrived at.

Chem. Soc. Mem.

FRANKLIN INSTITUTE.

Monthly Meeting, January 20, 1848.

After reading the minutes, and the correspondence received, donations were announced from the Zoological Society, London; Thomas Clemson, Esq., Brussels; Eben N. Horsford, Cambridge, Mass.; Pennsylvania Railroad Company, Union Canal Company, S. W. Roberts, Esq., T. H. Forsyth, Esq., and John Lenthall, Esq. Foreign and domestic exchanges for the Journal, were also announced. Reports from the Treasurer and various committees were received—new members proposed—and those proposed at last meeting elected.

On the report of the Committee on Exhibitions, the following resolution was adopted:

Resolved, That a First Premium be awarded to Jordon L. Mott, of New York, for Cooking Range No. 1784, shown at the last exhibition—a premium not having been awarded by the Committee at that time, under the impression that it had received a premium at the previous exhibition, which was not the case.

Communications on subjects connected with science and the arts, being next in order—

Mr. C. W. Chapman exhibited to the meeting a machine for sharpening tools, which he calls "the Universal Instrument Sharpener," and explained the mode of its operation. By a compact and ingenious arrangement of machinery, the foot of the operator communicates, at the same time, if required, a rotary motion to a vertical and to a horizontal grinding stone, and also a vibratory motion to a hone for finishing the edge. The stones may be easily changed, and coarser or finer ones substituted; or polishing wheels, if desirable. Adjustive rests and bevel plates are so adapted and regulated by scales, as to enable the grinder to give any desirable bevel to the edge, and to maintain it throughout. Feeders for water and oil are so arranged as to supply the stones, and keep them clean. The machine may also be applied to grinding porcelain, and cutting glass, or other hard substances. The axle of the vertical stone is terminated by a socket, into which drills may be inserted. So compact is the machinery for producing all the different motions, that it occupies little more than a cubic foot of space.

Mr. M'Comb, of Mississippi, exhibited a machine for pressing cotton, hay, tobacco, or hemp, intended to be worked by horse power. The horse is attached to a horizontal bar, fixed in a perpendicular shaft, around which winds a strong rope, fastened to toggle joints in two upright bars, on opposite sides of the revolving shaft. As these joints are drawn, by the rope, towards the shaft, the upward extension of the jointed bars forces up the moveable bottom of the box containing the material to be operated upon, and thus communicates the required pressure. The machine appears to be well calculated for working expeditiously and effectively. The inventor states that forty bales of cotton may be pressed in a day, with the same number of hands required for ten or twelve bales, by the ordinary method.

He also showed a model of a device for raising vessels when aground, called a Steamboat Spar, operating on the toggrel joint principle, and explained the mode of its application.

Mr. G. W. Smith called the attention of the meeting to specimens of manufactured Gutta Percha, by Mr. Willmarth, of New York. One of these was a sheet of the pure material, thin as paper, and somewhat similar, in appearance, to the finest oiled silk. Being impervious to water, it may be applied to many useful purposes, such as lining hats, shoes, and other articles of wear, covering the stoppers of bottles, and a variety of other uses. Mr. S. referred to its electric properties, which he had found to be very remarkable. He also exhibited a pair of shoes lined with this article, the soles of which were